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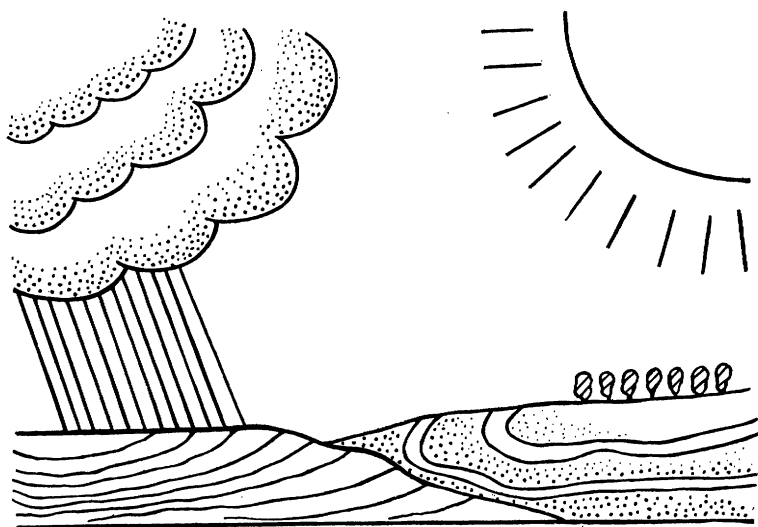
# YEARBOOK OF AGRICULTURE

1938



# Soils & Men

Yearbook of Agriculture 1938



UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES GOVERNMENT PRINTING OFFICE

# Organization

## *of the United States Department of Agriculture*

Corrected to July 1, 1938

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# Foreword

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THE EARTH is the mother of us all—plants, animals, and men. The phosphorus and calcium of the earth build our skeletons and nervous systems. Everything else our bodies need except air and sun comes from the earth.

Nature treats the earth kindly. Man treats her harshly. He overplows the cropland, overgrazes the pastureland, and overcuts the timberland. He destroys millions of acres completely. He pours fertility year after year into the cities, which in turn pour what they do not use down the sewers into the rivers and the ocean. The flood problem insofar as it is man-made is chiefly the result of overplowing, overgrazing, and overcutting of timber.

This terribly destructive process is excusable in a young civilization. It is not excusable in the United States in the year 1938.

We know what can be done and we are beginning to do it. As individuals we are beginning to do the necessary things. As a nation, we are beginning to do them. The public is waking up, and just in time. In another 30 years it might have been too late.

The social lesson of soil waste is that no man has the right to destroy soil even if he does own it in fee simple. The soil requires a duty of man which we have been slow to recognize.

In this book the effort is made to discover man's debt and duty to the soil. The scientists examine the soil problem from every possible angle. This book must be reckoned with by all who would build a firm foundation for the future of the United States.

For my own part I do not feel that this book is the last word. But it is a start and a mighty good start in helping all those who truly love the soil to fight the good fight.

HENRY A. WALLACE, *Secretary of Agriculture.*

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In charge of Part I, The Nation and the Soil, Bushrod W. Allin; Part II, The Farmer and the Soil, A. L. Patrick; Part III, Soil and Plant Relationships, M. A. McCall; Part IV, Fundamentals of Soil Science, and Part V, Soils of the United States, Charles E. Kellogg.

# Contents



Foreword . . . . .	HENRY A. WALLACE	PAGE V
The Committee on Soils . . . . .		VI
Soils and Men—A Summary . . . . .	GOVE HAMBIDGE	I

## Part I. The Nation and the Soil

Public Purposes in Soil Use		47
CARL C. TAYLOR, BUSHROD W. ALLIN, O. E. BAKER		
The Problem: Land Unfit for Farming in the Humid Areas		60
C. P. BARNES		
The Problem: Subhumid Areas		68
JOHN B. BENNETT, F. R. KENNEY, W. R. CHAPLINE		
The Problem: Drained Areas and Wildlife Habitats		77
F. R. KENNEY, W. L. M'ATEE		
The Problem: The Nation as a Whole		84
E. J. UTZ, CHARLES E. KELLOGG, E. H. REED, J. H. STALLINGS, E. N. MUNNS		
The Causes: Traditional Attitudes and Institutions		111
L. C. GRAY, JOHN B. BENNETT, ERICH KRAEMER, W. N. SPARHAWK		
The Causes: Defects in Farming Systems and Farm Tenancy		137
M. R. COOPER, W. J. ROTH, J. G. MADDOX, R. SCHICKELE, H. A. TURNER		
The Causes: Imperfections in Agricultural Finance		158
DAVID L. WICKENS, R. CLIFFORD HALL, DONALD JACKSON		
The Causes: Price Relations and Economic Instability		171
LOUIS H. BEAN, J. P. CAVIN, GARDINER C. MEANS		

The Remedies: Education and Research	PAGE 198
C. W. WARBURTON, C. B. MANIFOLD, CHARLES E. KELLOGG, C. P. BARNES	
The Remedies: Policies for Public Lands	223
EARLE H. CLAPP, E. N. MUNNS, I. H. SIMS, GEORGE S. WEHRWEIN, C. F. CLAYTON	
The Remedies: Policies for Private Lands	241
GEORGE S. WEHRWEIN, CLARENCE I. HENDRICKSON, M. H. SAUNDERSON, PHILIP M. GLICK, CARL C. TAYLOR, FRANCIS R. KENNEY, MARSHALL HARRIS	
The Remedies: Changes in Agricultural Finance	265
DONALD JACKSON, R. CLIFFORD HALL, ROY M. GREEN, DAVID L. WICKENS	
The Remedies: Direct Aids to Farmers	279
O. V. WELLS, J. P. CAVIN, D. S. MYER	
The Remedies: Economic Stabilization	289
O. V. WELLS, BUSHROD W. ALLIN	
The Soil and the Law	296
PHILIP M. GLICK	

## Part II. The Farmer and the Soil

Tillage	JOHN S. COLE, O. R. MATHEWS	321
Tillage Machinery	R. B. GRAY	329
Loss of Soil Organic Matter and Its Restoration	WILLIAM A. ALBRECHT	347
Soil Nitrogen	OSWALD SCHREINER, B. E. BROWN	361
Phosphorus Deficiency and Soil Fertility	W. H. PIERRE	377
Soil Potassium in Relation to Soil Fertility	II. P. COOPER, OSWALD SCHREINER, B. E. BROWN	397
Crop Rotation	CLYDE E. LEIGHTY	406



The Use of Cover and Green-Manure Crops		PAGE 431
	A. J. PIETERS, ROLAND MCKEE	
Farm Manure	ROBERT M. SALTER, C. J. SCHOLLENBERGER	445
The Nature and Use of Organic Amendments	IRVIN C. FEUSTEL	462
Determining the Fertilizer Requirements of Soils		469
	OSWALD SCHREINER, M. S. ANDERSON	
Fertilizer Materials		487
	OSWALD SCHREINER, ALBERT R. MERZ, B. H. BROWN	
Mixed Fertilizers	WILLIAM H. ROSS, ARNON L. MEHRING	522
Methods of Applying Fertilizers	ROBERT M. SALTER	546
Soil Acidity and Liming	EMIL TRUOG	563
General Aspects of the Soil-Erosion Problem		581
	HUGH H. BENNETT, W. C. LOWDERMILK	
Forests for Erosion Control		609
	E. N. MUNNS, JOHN F. PRESTON, IVAN H. SIMS	
Grass and Other Thick-Growing Vegetation in Erosion Control		615
	C. R. ENLOW, G. W. MUSGRAVE	
Strip Cropping	WALTER V. KELL	634
Mechanical Measures of Erosion Control		646
	M. L. NICHOLS, T. B. CHAMBERS	
The Coordinated Approach to Soil-Erosion Control	ERVIN J. UTZ	666
Special Dry-Farming Problems	O. R. MATHEWS, JOHN S. COLE	679
Irrigation in the United States		693
	WELLS A. HUTCHINS, M. R. LEWIS, P. A. EWING	
Soil, Water Supply, and Soil Solution in Irrigation Agriculture		704
	C. S. SCOFIELD	

Drainage in Arid Regions	JAMES THORP, C. S. SCOFIELD	PAGE 717
Drainage in the Humid Regions	JOHN R. HASWELL	723
Management of Forest Soils		737
	I. H. SIMS, E. N. MUNNS, JOHN T. AUTEN	

### Part III. Soil and Plant Relationships

The Soil Requirements of Economic Plants		753
	M. F. MORGAN, J. H. GOURLEY, J. K. ABLEITER	
Some Relationships of Soil to Plant and Animal Nutrition—The Major Elements		777
	C. A. BROWNE	
Neglected Soil Constituents That Affect Plant and Animal Development		807
	J. E. MCMURTREY, JR., W. O. ROBINSON	
Selenium in Soils	K. T. WILLIAMS	830
Plants as Soil Indicators	H. L. SHANTZ	835

### Part IV. Fundamentals of Soil Science

Soil and Society	CHARLES E. KELLOGG	863
The Physical Nature of Soil	T. D. RICE, L. T. ALEXANDER	887
Water Relations of Soils	L. B. OLMSTEAD, W. O. SMITH	897
General Chemistry of the Soil		911
	HORACE G. BYERS, M. S. ANDERSON, RICHARD BRADFIELD	
Soil Organic Matter and Soil Humus	CONSTANTIN C. NIKIFOROFF	929
Fauna and Flora of the Soil	CHARLES THOM, NATHAN R. SMITH	940
Formation of Soil		948
	H. E. BYERS, CHARLES E. KELLOGG, M. S. ANDERSON, JAMES THORP	

Soil Classification	PAGE 979
MARK BALDWIN, CHARLES E. KELLOGG, JAMES THORP	
Soil Maps and Their Use	J. KENNETH ABLEITER 1002

Part V. Soils of the United States

Soils of the United States . . . . .	1019
SOIL SURVEY DIVISION, BUREAU OF CHEMISTRY AND SOILS	
A Glossary of Special Terms Used in the Soils Yearbook . . .	1162
Literature Cited . . . . .	1181
Index . . . . .	1209

**NOTE:** The Annual Report of the Secretary of Agriculture to the President of the United States for 1937, hitherto printed in the Yearbook, has been omitted from this volume. It is published as a separate document and may be obtained from the Superintendent of Documents, Washington, D. C., at 15 cents a copy.

# A Glossary of Special Terms Used in the Soils Yearbook<sup>1</sup>

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**A HORIZON**—See Horizon, soil.

**ABC SOIL**—A soil with a completely differentiated profile, including an A, a B, and a C horizon. (See Profile; Horizon.)

**AC SOIL**—A soil having an incomplete profile with only A and C horizons. A soil having no clearly developed B horizon. (See Profile; Horizon.)

**ACID SOIL**—A soil giving an acid reaction (precisely, below pH 7.0; practically, below pH 6.6) throughout most or all of the portion occupied by roots. More technically, a soil having a preponderance of hydrogen ions over hydroxylions in the soil solution. Indicator dyes (e. g., litmus) may be used for its determination. (See pH; Reaction, soil.)

**AGGREGATE (of soil)**—A single mass or cluster of soil consisting of many soil particles held together, such as a clod, prism, crumb, or granule.

**AGRICULTURAL LAND**—See Land.

**AGRICULTURAL PRODUCTION**—Production from crop or livestock enterprises on farms.

**AGROLOGY**—See Pedology.

**AGRONOMY**—See Pedology.

**ALKALI SOIL**—A soil containing alkali salts, usually sodium carbonate (with a pH value of 8.5 and higher). The term is frequently used loosely to include both alkali soil and saline soil as here defined. Where applied to saline soil the expression "white alkali" is used in some localities, and the expression "black alkali" is used for alkali soil as here defined, with or without the presence of neutral salts. (See pH; Saline soil.)

**ALKALINE SOIL**—Any soil that is alkaline in reaction. (Precisely, above pH 7.0; practically, above pH 7.3.) (See pH; Reaction, soil.)

**ALLUVIAL SOILS**—Azonal group of soils, developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes. (See Alluvium; Azonal soils.)

**ALLUVIUM**—Fine material, such as sand, mud, or other sediments deposited on land by streams.

**ALPINE (Mountain) MEADOW SOILS**—Intrazonal group of dark-colored soils of the open or sparsely timbered and usually rather wet meadows found on high altitudes near and above the timber line. (See Intrazonal soil.)

**AMMONIFICATION**—Formation of ammonium compounds, or ammonia, as in soils, by soil organisms.

<sup>1</sup> This glossary is not intended to be a dictionary of all terms used in soil science and related disciplines. It is by no means complete; it omits entirely the soil series names, and makes no attempt to include the technical terms used in the more specialized phases of soil physics, soil chemistry, and soil microbiology. In many instances explanations have been given rather than strict definitions, especially where terms have been used previously in more than one sense and where preciseness of definition would lead to extreme technicality. Competent authorities are not entirely agreed on the definition of some of the terms, and, although an attempt has been made to reflect the most commonly accepted ideas of the day, some almost arbitrary selection has been necessary. The definitions and explanations have been checked by a few leading soil scientists in the United States and further comments will be welcome. Terms that are new or that are used in a relatively new sense are marked with an asterisk (\*). A further explanation of many of these will be found in the text of the book.

- ANION**—An ion carrying a negative charge of electricity. (See Ion.)
- ARABLE LAND**—See Land.
- ARID CLIMATE**—See Climate.
- ASH**—The nonvolatile residue resulting from the complete ignition (burning) of organic matter.
- ASSOCIATION, SOIL**—A group of soils, with or without common characteristics, geographically associated in an individual pattern. (An association may include one or more catenas. If the individual members of the association are not separable on a map of the scale employed, the association is considered a complex.) (See Catena; Complex.)
- AZONAL SOILS**—Any group of soils without well-developed profile characteristics, owing to their youth or conditions of parent material or relief, that prevent the development of normal soil-profile characteristics. In the United States these groups include the following: Alluvial soils, Lithosols (skeletal soils), and some dry sands. (See Alluvial soils; Dry sands; Lithosols; Profile.)
- B HORIZON**—See Horizon, soil.
- BADLAND**—See Land.
- BASE MAP**—A map having sufficient points of reference, such as State, county, or township lines, and other selected physical and cultural features, to allow the plotting of other special data. The base map for a detailed soil map shows political subdivisions, permanent physical features such as streams, shore lines, and mountains, and such cultural features as houses and roads, necessary for convenience in plotting the soil data. (See Soil map.)
- BASIN LISTING**—A method of tillage which creates small basins by damming lister furrows at regular intervals of approximately 4 to 20 feet. This facilitates retention, penetration, and uniform distribution of moisture and retards erosion on sloping lands.
- BC SOIL**—A soil with a profile having no A horizon. (Presumably the A horizon has been removed by erosion in most instances.) (See Horizon; Profile.)
- BEDROCK**—The solid rock underlying soils and other superficial formations.
- BOG SOILS**—An intrazonal group of soils with a muck or peaty surface soil underlain by peat, developed under swamp or marsh types of vegetation, mostly in a humid or subhumid climate. (See Intrazonal; Muck; Peat.)
- BRECCIA**—A fragmental rock with angular components as distinguished from conglomerate with water-worn components. There are friction or fault breccias, talus breccias, and erupted breccias.
- BROWN FOREST SOILS**—An intrazonal group of soils with very dark brown surface horizons, relatively rich in humus (mull) grading through lighter colored soil into the parent material, and characterized by slightly acid reaction, little or no illuviation of iron and alumina, and a moderately high content of calcium in the soil colloids. Developed under the deciduous forest in temperate humid regions from parent material relatively rich in bases. (See Colloid, soil; Eluviation; Horizon; Humus; Intrazonal; Parent material.)
- \*BROWN PODZOLIC SOILS**—A zonal group of soils with a thin mat of partly decayed leaves over very thin dark grayish-brown humus-mineral soil and a trace of pale-gray leached A<sub>2</sub> horizon over a brown or yellowish-brown B horizon heavier in texture than the surface soil; developed under deciduous or mixed deciduous and coniferous forest in temperate or cool-temperate humid regions. (See Horizon; Zonal.)
- BROWN SOILS**—A zonal group of soils having a brown surface horizon which grades below into lighter colored soil and finally into a layer of carbonate accumulation; developed under short grasses, bunch grasses, and shrubs in a temperate to cool, semiarid climate. (See Carbonate accumulation; Horizon; Zonal.)
- C HORIZON**—See Horizon, soil.
- CALCAREOUS SOIL**—Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly to the naked eye when treated with hydrochloric acid. Soil alkaline in reaction, owing to the presence of free calcium carbonate. (See Reaction, soil.)
- CALCIFICATION**—A general term used for that process or those processes of soil formation in which the surface soil is kept supplied sufficiently with calcium to saturate the soil colloids to a high degree with exchangeable calcium and thus render them relatively immobile and nearly neutral in reaction. The

- process is best expressed in Chernozem and other soils having a horizon of carbonate accumulation. (See Carbonate accumulation; Chernozem soils; Colloid, soil; Exchange; Horizon; Reaction, soil.)
- CALICHE**—A more or less cemented deposit of calcium carbonate or of mixed calcium and magnesium carbonates, characteristic of soils of warm or hot desert and semiarid regions.
- \***CALOMORPHIC SOILS**—Suborder of intrazonal soils owing their chief characteristics to the high content of calcium available to plants (frequently, but not always, in the form of soft calcium carbonate) in the parent material, such as Brown Forest and Rendzina soils. (See Brown Forest soils; Intrazonal; Parent material; Rendzina soils; Suborder.)
- CARBON-NITROGEN RATIO**—The relative proportion, by weight, of organic carbon to nitrogen in a soil. The number obtained by dividing the percentage of organic carbon in a soil by the percentage of nitrogen.
- CARBONATE ACCUMULATION, SOIL HORIZON OF**—A developed soil horizon, beneath the surface, containing more calcium (or magnesium and calcium) carbonate than the soil above it or the soil material below it. Characteristic of the Pedocal soils of Marbut's classification. (See Horizon; Pedocal.)
- CATEGORY (soil classification)**—Any one of the subdivisions of the system of classification in which soils are arranged on the basis of their characteristics. Beginning with the lowest category, soil type, soils are classified on the basis of progressively fewer characteristics into groups of progressively higher or more inclusive categories, namely, series, family, great soil group, suborder, and order. (See Family, soil; Great soil group; Order; Series; Suborder.)
- CATENA, SOIL**—A group of soils within one zonal region developed from similar parent material but differing in characteristics of the solum owing to differences in relief or drainage. From the Latin for chain. (See Parent material; Solum.)
- CATION**—An ion carrying a positive charge of electricity. (See Ion.)
- CHERNOZEM SOILS**—A zonal group of soils having a deep, dark-colored to nearly black surface horizon, rich in organic matter, which grades below into lighter colored soil and finally into a layer of lime accumulation; developed under tall and mixed grasses in a temperate to cool subhumid climate. From the Russian for black earth. Sometimes spelled Tschernosem, Tschernosiom. (See Carbonate accumulation; Horizon; Zonal soil.)
- CHELT**—An amorphous (without definite structure) form of silica ( $\text{SiO}_2$ ) very closely allied to flint and characterized by a splintery fracture.
- CHESTNUT SOILS**—A zonal group of soils having a dark-brown surface horizon which grades below into lighter colored soil and finally into a horizon of lime accumulation; developed under mixed tall and short grasses in a temperate to cool and subhumid to semiarid climate. They occur on the arid side of Chernozem soils, into which they grade. (See Carbonate accumulation; Chernozem soils; Horizon; Zonal.)
- \***CHISEL**—Any machine carrying one or more soil-penetrating points, with sufficient weight to force the points into the soil to a depth of 12 to 18 inches, so that they may be drawn along at that depth to loosen the subsoil. (See Subsoil.)
- CLAY**—The small mineral soil grains, less than 0.002 mm in diameter. (Formerly included the grains less than 0.005 mm in diameter.)
- CLAYPAN**—A dense and heavy soil horizon underlying the upper part of the soil; hard when dry and plastic or stiff when wet; presumably formed in part by the accumulation of clay brought in from the horizons above by percolating water. Common in many of the Planosols. (See Clay; Horizon; Planosol.)
- CLIMATE:**
- Arid*—A dry climate characteristic of desert and semidesert regions where precipitation effectiveness is such that only a sparse vegetation of desert plants prevails. The limits of precipitation vary considerably according to temperature conditions, with an upper limit for cool regions of 10 inches or less and for tropical regions of as much as 15 or 20 inches. (The Thornthwaite precipitation-effectiveness (P-E) index ranges between 0 and 16.) (See Precipitation effectiveness.)
- Continental*—A general term for the climate typical of great land masses, characterized by a great range of temperature and occurring in such parts of a continent as are not affected materially by nearness to the sea or other modifying influences.

*Humid*—Generally, a climate with sufficient precipitation to support a forest vegetation, although there are exceptions. The lower limit of precipitation in cool regions may be as little as 20 inches, whereas in hot regions it may be as much as 60 inches. The Thornthwaite precipitation-effectiveness index ranges between 64 and 128. The term "humid" also applies to atmospheric conditions. In this sense a humid climate is one in which the average relative humidity, as measured by the hygrometer, is very high. (See Precipitation effectiveness.)

*Mediterranean*—A general term used in reference to warm-temperate climates, relatively dry in the warm season and relatively moist in the cool season.

*Oceanic*—A general term for a climate modified by the tempering effect of ocean water, such that temperatures do not reach great extremes in either direction.

*Semiarid*—Climate characteristic of the regions intermediate between the true deserts and subhumid areas under which precipitation effectiveness is such that a vegetation of scattered short grass, bunch grass, or shrubs prevails. The upper limit of average annual precipitation in the cool semiarid regions is as low as 15 inches, whereas in tropical regions it is as high as 45 or possibly 50 inches. The Thornthwaite precipitation-effectiveness (P-E) index ranges between 16 and 32. (See Precipitation effectiveness.)

*Subhumid*—A climate intermediate between semiarid and humid, with sufficient precipitation to support a moderate to dense growth of tall and short grasses but in most instances insufficient to support a dense deciduous forest. Some subhumid areas, where the rainfall comes mostly during the growing season, have scattered deciduous trees with grass vegetation between. The upper limit of rainfall in subhumid climates may be as low as 20 inches in cool regions and as high as 60 inches in hot areas. Thornthwaite precipitation-effectiveness indexes are 32 to 48 for the dry subhumid and 48 to 64 for the moist subhumid. (See Precipitation effectiveness.)

*Wet*—The climate in which precipitation effectiveness is such that rain-forest vegetation prevails. The Thornthwaite precipitation-effectiveness index is above 128. (See Precipitation effectiveness.)

*Wet-dry*—The term "wet-dry" is applied to climate to indicate alternating wet and dry seasons, such as a wet summer and a dry winter, or the reverse. Some consider the climatic condition in the trade-wind belt, where daily showers are interspersed with dry sunny weather, to be wet-dry. The term is used more commonly, however, to apply to alternating wet and dry seasons.

**COLLOID, SOIL**—The term "colloid" is used in reference to matter, both inorganic and organic, having very small particle size and a correspondingly high surface area per unit of mass. Individual soil colloid particles are generally submicroscopic, or nearly so, but may be aggregated so that internal surface plays an important part. Furthermore, soil colloids differ from noncolloidal soil material in other ways than particle size. Formerly it was thought that the colloidal particles are not crystalline; now it is known that many mineral colloids exhibit crystalline structure when subjected to X-ray examination. Under certain conditions soil colloids form a more or less stable suspension or dispersion in water (colloidal solution) which is distinguished from true solution in that all particles have not dispersed to the molecular state. Colloids do not diffuse readily or pass through many animal or vegetable membranes. From the Greek for glue.

**COLLUVIUM**—Heterogeneous deposits of rock fragments and soil material accumulated at the base of comparatively steep slopes through the influence of gravity, including creep and local wash.

**COMPLEX, SOIL**—A soil association composed of such an intimate mixture of areas of soil series, types, or phases that these cannot be indicated separately upon maps of the scale used so that the association is mapped as a unit. (See Association, soil; Series, soil; Phase, soil; Type, soil.)

**CONCRETIONS**—Local concentrations of certain chemical compounds, such as calcium carbonate or compounds of iron, that form hard grains or nodules of mixed composition and of various sizes, shapes, and coloring.

**CONSISTENCE, SOIL**—The relative mutual attraction of the particles in the whole soil mass or their resistance to separation or deformation (as evidenced in cohesion and plasticity). Consistence is described by such general terms as loose or open; slightly, moderately, or very compact; mellow; friable; crumbly; plastic; sticky; soft; firm; hard; and cemented.

- CONSOLIDATED** (soil material)—Made solid, by cementation or other processes, from a previous fluid or loosely aggregated condition.
- CONTINENTAL CLIMATE**—See Climate.
- CONTOUR FURROWS**—Furrows plowed at right angles to the direction of slope, at the same level throughout and ordinarily at comparatively close intervals. They, together with the ridges produced by making the furrows, intercept and retain run-off water, thereby facilitating erosion control and moisture distribution, penetration, and retention.
- CROPLAND**—See Land.
- CRUST**—A brittle layer of hard soil formed on the surface of many soils when dry.
- CRUST, DESERT**—A hardpan of calcium carbonate, gypsum, or other binding material exposed at the surface in desert regions by wind or water erosion. Some think that desert crusts form on the surface, but it is believed that more of them form in the soil and are exposed by subsequent erosion.
- CRYSTALLINE ROCK**—A general term including igneous and metamorphic rocks composed of minerals in crystalline form. (See *Igneous rock*; *Metamorphic rock*.)
- DEALKALIZATION**—Removal of alkali from the soil, usually by leaching. Technically, replacement of monovalent metallic ions, such as sodium, by alkaline earth cations, such as calcium, or by hydrogen ions. (See *Cation*; *Ion*; *Leaching*.)
- DECALCIFICATION**—Removal of calcium carbonate from the soil by leaching. Technically, replacement of calcium ions by monovalent cations. (See *Cation*; *Ion*; *Leaching*.)
- DEFLOCCULATE**—To separate or break down soil aggregates of clay into their individual particles; e. g., the dispersion of the particles of a granulated colloid to form a clay which tends to run or puddle. (See *Clay*; *Colloid*.)
- DEGRADATION** (of soils)—Change of one soil type to a more highly leached one; e. g., the podzolization of a soil originally developed under the calcification process, as in the formation of a Podzol from a Chernozem. Sometimes used incorrectly to denote a decrease of soil fertility. (See *Calcification*; *Chernozem soils*; *Leaching*; *Podzolization*; *Podzol soils*; *Type, soil*.)
- DEGRADED CHERNOZEM**—A zonal group of soils having a very dark brown to black surface horizon underlain by a dark- to light-gray leached horizon which rests upon a brown horizon; developed in the region between Chernozem and podzolic soils, where the forest vegetation has encroached upon grassland. (See *Chernozem soils*; *Horizon*; *Leaching*; *Podzolic soils*; *Zonal soil*.)
- DENDRITIC**—Marked by a branching habit resembling that of a shrub or tree; usually said of river systems, various plants, and of the veins of leaves of many higher plants.
- DENITRIFICATION**—The reduction of nitrates to nitrites, ammonia, and free nitrogen, as in soil by soil organisms, particularly anaerobic organisms (those living or active in the absence of air or free oxygen), under certain conditions.
- DESALINIZATION**—Removal of salts from soil, usually by leaching. (See *Leaching*.)
- DESERT SOILS**—A zonal group of soils having a light-colored surface soil, usually underlain by calcareous material and frequently by a hardpan; developed under an extremely scant shrub vegetation in warm to cool arid climates. (See *Hardpan*; *Zonal soil*.)
- DETRITUS**—A heterogeneous mass of fragments of stone or earth.
- DRIFT**—Material of any sort deposited in one place after having been moved from another. Glacial drift includes glacial deposits, unstratified (till) and stratified glacial outwash materials.
- DRY SANDS**—An azonal group of soils consisting of well-drained sandy deposits in which no clearly expressed soil characteristics have developed. (See *Azonal soil*; *Sand*.)
- DRUMLIN**—An oval hill of glacial drift, normally compact and unstratified, usually with its longer axis parallel to the movement of the ice responsible for its deposition. (See *Drift*.)
- DUFF**—A type of organic surface horizon of forested soils, consisting of matted peaty organic matter only slightly decomposed. (See *Horizon*.)



- ECOLOGY**—The branch of biology which deals with the mutual relations between organisms and their environment.
- EDAPHIC**—A general term for soil influences or conditions.
- EDAPHOLOGY**—A term sometimes used for soil science, particularly for those phases of the science dealing with the influences of soil upon vegetation. (See Pedology.)
- ELECTROLYTE**—(1) Any conductor of the electric current in which chemical change accompanies the passage of the current and is proportional to the current passed. Usually electrolytes are solutions of substances in a liquid. (2) By extension of meaning, any substance which, when added to a solvent, forms such a conductor; e. g., salt which, when added to water, forms an electrolyte.
- ELUVIATION**—The movement of soil material from one place to another within the soil, in solution or in suspension, when there is an excess of rainfall over evaporation. Horizons that have lost material through eluviation are referred to as eluvial and those that have received material as illuvial. Eluviation may take place downward or sidewise according to the direction of water movement. As used, the term refers especially, but not exclusively, to the movement of colloids, whereas leaching refers to the complete removal of material in solution. (See Horizon; Leaching.)
- EROSION (LAND)**—The wearing away of the land surface by running water, wind, or other geological agents, including such processes as gravitational creep.
- Normal*—The erosion characteristic of the land surface in its natural environment, undisturbed by human activity, as under the protective cover of the native vegetation. This type of erosion is sometimes referred to as geological erosion. It includes (1) rock erosion, or erosion of rocks, consolidated or unconsolidated, on which there is little or no true soil, as in stream channels, high mountains, and badlands, and (2) normal soil erosion, or the erosion characteristic of the soil type in its natural environment under the native vegetation, undisturbed by human activity.
- Accelerated*—Erosion of the soil or rock over and above normal erosion brought about by changes in the natural cover or ground conditions, including changes due to human activity and those caused by lightning or rodent invasion.
- Sheet*—Removal of a more or less uniform layer of material from the land surface. The effects are less conspicuous than those of other types of erosion that produce large channels. Frequently in sheet erosion the eroding surface consists of numerous very small rills.
  - Rill*—That type of accelerated erosion by water which produces small channels that can be obliterated by tillage.
  - Gully*—That type of accelerated erosion by water which produces channels larger than rills. Ordinarily, these erosion-produced channels carry water only during and immediately after rains, or following the melting of snow. Gullies are deeper than rills and are not obliterated by normal tillage.
- Soil*—Removal of soil material from the solum by wind or running water, including normal soil erosion and accelerated soil erosion. Sometimes used loosely in reference to accelerated erosion only.
- EXCHANGE**—As a chemical term, a reaction between two substances involving an interchange of parts.
- FAMILY, SOIL**—A category in soil classification between series and great soil group; a taxonomic group of soils having similar profiles, composed of one or more distinct soil series. (See Category; Great soil group; Profile; Series, soil.)
- FERRUGINOUS**—Iron-bearing; usually refers to material of comparatively high iron oxide content.
- FERTILITY (of soil)**—The quality that enables a soil to provide the proper compounds, in the proper amounts and in the proper balance for the growth of specified plants, when other factors, such as light, temperature, and the physical condition of the soil, are favorable.
- FIRST BOTTOM**—The normal flood plain of a stream, part of which may be flooded only at infrequent intervals. (See Flood plain; Second bottom.)
- FLOCCULATE**—To aggregate individual particles into small groups or granules; used especially with reference to clay and colloid behavior. (See Clay; Colloid, soil.)

**FLOOD PLAIN**—The nearly flat surface subject to overflow along stream courses.

**FOOD, PLANT**—The organic compounds, elaborated within the plant, which nourish its cells. (Sometimes used loosely as an equivalent of plant nutrient.)

**FOREST LAND**—See Land.

**FORMULA WEIGHT**—The formula weights of compounds are the sums of the atomic weights represented in the formulas. The formula weights of  $\text{Al}_2\text{O}_3$ ,  $\text{H}_2\text{SO}_4$ , and  $\text{SiO}_2$  are therefore, respectively,  $(2 \times 27) + (3 \times 16) = 102$ ,  $(2 \times 1) + 32 + (4 \times 16) = 98$ , and  $28.1 + (2 \times 16) = 60.1$ .

**FREE**—(As of silica, ferric oxide, etc.) A condition of a substance occurring in a mixture, where it is not chemically combined with other components of the mixture. Usually applied to iron oxide, alumina, and silica existing as such in contrast to the combined forms; e. g.,  $\text{SiO}_2$  is free silica, whereas kaolin— $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ —contains combined silica.

**FRIABLE**—Easily crumbled in the fingers; nonplastic.

**GENESIS, SOIL**—Mode of origin of the soil, referring particularly to the processes responsible for the development of the solum from the unconsolidated parent material. (See Parent material; Solum.)

**GENETIC**—Pertaining to genesis or beginning.

**GEOLOGICAL EROSION**—See Erosion.

**GLACIAL SOIL MATERIAL**—Parent material of soil that has been moved and redeposited by glacial activity. (See Parent material.)

**GLAUCONITE**—An amorphous (without definite structure) silicate of iron and potassium. Considerable aluminum may be present also.

**\*GLEIZATION**—A general term for the process of soil formation leading to the development, under the influence of excessive moistening, of a glei (gley) horizon in the lower part of the solum. A soil horizon in which the material ordinarily is bluish gray or olive gray, more or less sticky, compact, and often structureless, is called a glei horizon and is developed under the influence of excessive moistening. The process is important in the development of the Wiesenböden, Bog, and Half Bog soils. (See Bog soils; Half Bog soils; Horizon, soil; Solum; Wiesenböden.)

**GRAY-BROWN PODZOLIC SOILS**—A zonal group of soils having a comparatively thin organic covering and organic-mineral layers over a grayish-brown leached layer which rests upon an illuvial brown horizon; developed under deciduous forest in a temperate moist climate. (See Horizon, soil; Leaching; Zonal soil.)

**GRAZING LAND**—See Land.

**GREAT SOIL GROUP (soil classification)**—A group of soils having common internal soil characteristics; includes one or more families of soils. Among the zonal soils, each great soil group includes the soils having common internal characteristics developed through the influence of environmental forces of broad geographic significance, especially vegetation and climate; among the intrazonal soils, each great soil group includes the soils having common internal characteristics developed through the influence of environmental forces of both broad and local significance; among the azonal soils each great soil group includes similar soils that are without developed characteristics, owing to the influence of some local condition of parent material or relief. (See Azonal soil; Family, soil; Intrazonal soil; Parent material; Zonal soil.)

**GREEN-MANURE CROP**—Any crop grown and plowed under for the purpose of improving the soil, especially by the addition of organic matter.

**\*GROUND-WATER LATERITE SOILS**—An intrazonal group of soils with bleached A horizons containing some concretions and more or less thick, cellular hardpans composed largely of iron and aluminum compounds; and with an alternating high and low water table. Found under warm-temperate to tropical climates. (See Concretions; Hardpan; Horizon, soil; Intrazonal soil; Water table.)

**GROUND-WATER PODZOL SOILS**—An intrazonal group of soils, developed from imperfectly drained sandy deposits in humid regions, having a thin organic layer over a light-gray sandy leached layer which rests upon a dark-brown B horizon irregularly cemented with iron or organic compounds, or both. The B horizon is called ortstein when cemented into a massive hardpan, and orterde where slightly and irregularly cemented. (See Hardpan; Horizon, soil; Intrazonal soil; Leaching; Orterde; Ortstein.)

**GULLY EROSION**—See Erosion.

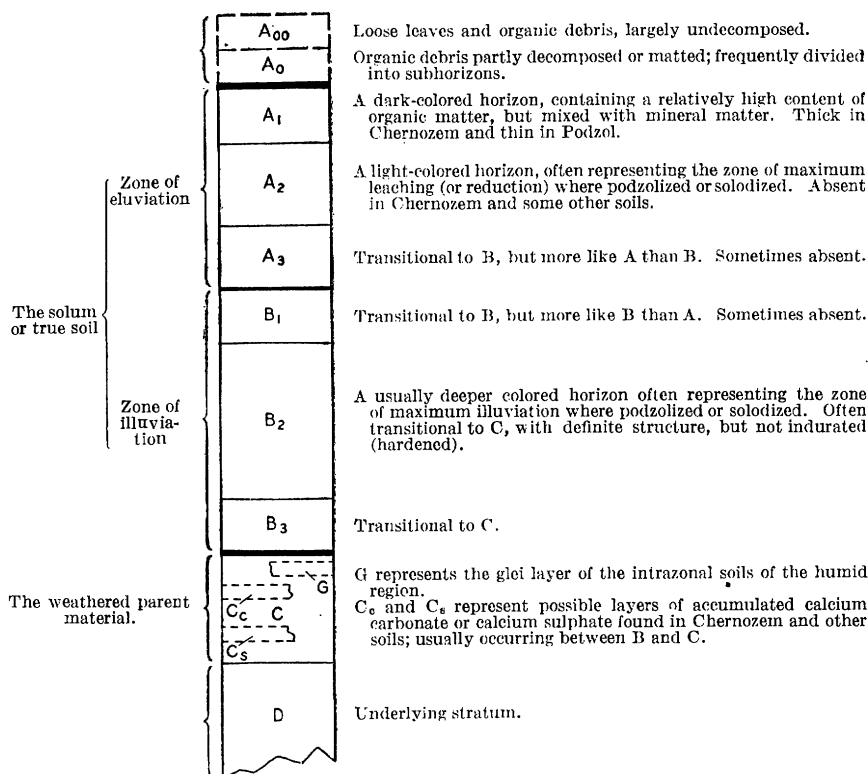
**HALF BOG SOILS**—An intrazonal group of soils with mucky or peaty surface soil underlain by gray mineral soil; developed largely under swamp-forest types of vegetation, mostly in a humid or subhumid climate. (See Intrazonal soil.)

**\*HALOMORPHIC SOILS**—A suborder of intrazonal soils, the properties of which are determined by the presence of neutral or alkali salts, or both. Halo is from the Greek for salt. (See Intrazonal soil; Suborder.)

**HALOPHYTIC VEGETATION**—Salt-loving or salt-tolerant vegetation, usually having fleshy leaves or thorns and resembling desert vegetation. Halo is from the Greek for salt.

**HARDPAN**—An indurated (hardened) or cemented soil horizon. The soil may have any texture and is compacted or cemented by iron oxide, organic material, silica, calcium carbonate, or other substances. (See Horizon, soil; also Desert, Ground-Water Laterite, Ground-Water Podzol, and Planosol soils.)

**HORIZON, SOIL**—A layer of soil approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil-building processes. The relative positions of the several soil horizons in the soil profile and their nomenclature are shown below:



Important subdivisions of the main horizons are conveniently indicated by extra numerals, thus: A<sub>21</sub> and A<sub>22</sub> represent subhorizons within A<sub>2</sub>. (See Calcium carbonate accumulation; Chernozem soils; Eluviation; Gleization; Intrazonal soil; Parent material; Podzolized; Podzol soils; Profile; Solodized; Solum.)

**HUMID CLIMATE**—See Climate.

**HUMUS**—The well-decomposed, more or less stable part of the organic matter of the soil.

**IGNEOUS ROCK**—A rock produced through the cooling of melted mineral material.

**ILLUVIATION**—See Eluviation.

**IMMATURE SOIL**—A young or imperfectly developed soil.

**INHERITED CHARACTERISTIC** (of soils)—Any characteristic of soil that is due directly to the nature of the parent material as contrasted to those partly or wholly due to the processes of soil formation. Example, the red color of a soil is said to be inherited if it is due entirely to the fact that the parent material is red.

**INTRAZONAL SOIL**—Any of the great groups of soils with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of the climate and vegetation. Each group of these soils may be found associated with two or more of the zonal groups. In the United States the groups included are as follows (the terms are defined in this glossary): Brown Forest soil, Rendzina, Bog, Half Bog, Wiesenböden, Alpine Meadow, Ground-Water Podzol, Ground-Water Laterite, Planosol, Solonchak, Solonetz, and Soloth. (See Great soil group; Parent material; Zonal soil.)

**ION**—An electrically charged element or group of elements in an electrolyte. More broadly, an electrically charged particle. (See Electrolyte.)

**KAME**—A short irregular ridge, hill, or hillock of stratified glacial drift. Most kames are hilly and are interspersed with depressions sometimes known as "kettles," having no surface drainage. (See Drift.)

**LACUSTRINE DEPOSITS**—Materials deposited by lake waters.

**LAND**—The total natural and cultural environment within which production must take place. Its attributes include climate, surface configuration, soil, water supply, subsurface conditions, etc., together with its location with respect to centers of commerce and population. It should not be used as synonymous with soil or in the sense of the earth's surface only.

**Agricultural**—Land in farms regularly used for agricultural production. The term includes all the land devoted to crop or livestock enterprises; i. e., the farmstead, lanes, drainage and irrigation ditches, water supply, cropland, and grazing land of every kind in farms. It should not be used as synonymous with land in farms, cropland, pasture land, land suitable for crops, or land suitable for farming. The term "nonagricultural land" should not be used in the sense of land not suited to crops; such terms as "nonplowable," "nonarable," "land not in farms," and "land unsuited to crops," to suit the case, are preferable.

**Arable**—Land which, in its present condition, is physically capable, without further substantial improvement, of producing crops requiring tillage.

**Badland**—Nearly or partly barren, rough, broken land strongly dissected by streams; most common in semiarid and arid regions, where streams have entrenched themselves in soft geological materials, such as clays, soft shales, sandstones, and limestones.

**Cropland**—Land regularly used for crops, except forest crops. Cropland includes rotation pasture, cultivated summer fallow, or other land ordinarily used for crops but temporarily idle.

**Forest**—Land not in farms, bearing a stand of trees of any age or stature, including seedlings (reproduction), but of species attaining a minimum average height of 6 feet at maturity, or land from which such a stand has been removed, which is not now restocking, and on which no other use has been substituted. Forest on farms is called farm woodland or farm forest.

**Grazing**—Land regularly used for grazing, except cropland and rotation pasture. It is not confined to land suitable only for grazing.

**Scabland**—Land characterized by numerous outcrops of lava rock or scoria. This term, or "scabby land," is also applied locally to land having a large number of bare spots of Solonetz or solodized-Solonetz soils. (See Scoria; Solodized; Solonetz.)

**Waste**—Land essentially incapable of producing materials or services of value. This term should not be used to describe idle farm or forest land.

**LANDSCAPE** (as used in soil geography)—The sum total of the characteristics that distinguish a certain area on the earth's surface from other areas. These characteristics are the result not only of natural forces but of human occupancy and use of the land. Included among them are such features as soil types, vegetation, rock formations, hills, valleys, streams, cultivated fields,

roads, and buildings. All of these features together give the area its distinguishing pattern. The term may be used in a broad sense to include the complex pattern of an extensive area, such as the rural landscape, the mountain landscape, or the Chernozem landscape, or it may be restricted more closely by some factor or combination of factors, as the landscape of the Miami-Brookston soil association, the landscape of the Miami silt loam, or the landscape of the forested Plainfield sand.

**LAND CLASSIFICATION**—Classification of specific bodies of land according to their characteristics or to their capabilities for use. A natural land classification may be defined as one in which the natural land types are placed in categories according to their inherent characteristics. A land classification according to use capabilities may be defined as one in which bodies of land are classified (on the basis of physical or both physical and economic considerations) according to their capabilities for man's use, with sufficient detail of categorical definition and cartographic (mapping) expression to indicate those differences significant to men. (See *Category*.)

**LAND RECLAMATION**—Making land capable of more intensive use by changing its character, environment, or both through operations requiring collective effort. The clearing of stumps, brush, and stones from land, or simple techniques of erosion control that can be effected by the individual, are not to be included with reclamation.

**LAND TYPE**—Land uniformly possessed of particular distinguishing characteristics. A natural land type is land having a particular set of defined natural characteristics, principally of soil, climate, relief, stoniness, and native vegetation.

**LAND USES, MAJOR RURAL**—(1) Crop production (production of crops ordinarily harvested by man, except forest). (2) Grazing. (3) Forestry (production of repeated crops of forest products). (4) Recreation, including observation for educational purposes. (5) Wildlife preservation, propagation, or both. (6) Mineral extraction. (7) Protection (use of land to prevent injury to water supplies or to other more valuable land).

**LAND-USE PATTERN**—The areal design or arrangement of land uses, major and minor, and of operation units.

**LAND-USE PLANNING**—The development of plans for the uses of land that will, over a long period, best serve the general welfare, together with the formulation of ways and means of achieving such uses.

**LATERITE SOILS**—The zonal group of soils having very thin organic and organic-mineral layers over reddish leached soil that rests upon highly weathered material, relatively rich in hydrous alumina or iron oxide, or both, and poor in silica; usually deep-red in color. Laterite soils are developed under the tropical forest in a hot, moist, or wet-dry climate with moderate to high rainfall. (This definition is somewhat broader than some authorities might care to accept. The term is sometimes restricted to the highly weathered material with definite reticulate mottling as first described in India.) From the Latin for brick. (See *Leaching*; *Reticulate mottling*; *Zonal soil*.)

**LATERIZATION (Lateritization)**—The characteristic process which tends toward the production of Laterites and lateritic soils. Essentially it is the process of the silica removal with consequent increase in the alumina and iron oxide content and decrease in base-exchange capacity of the soil. (See *Exchange*; *Laterite soils*.)

**LEACHING**—Removal of materials in solution.

**LIME**—Strictly, calcium oxide ( $\text{CaO}$ ), but, as commonly used in agricultural terminology, calcium carbonate ( $\text{CaCO}_3$ ) and calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) are included. Agricultural lime refers to any of these compounds, with or without magnesia, used as an amendment for acid soils.

**LIMESTONE**—A general name for rocks composed essentially of calcium carbonate. There are a great many different varieties varying in physical and chemical composition. Among these may be mentioned coralline limestone, composed of fragments of coral; dolomitic limestone, composed of a mixture of calcium and magnesium carbonates with minor impurities; and oolitic limestone, consisting of small, round grains resembling the roe of fish cemented together. Some dolomitic and oolitic limestones are composed of small roundish shells of minute animals.

\***LITHOSOLS (skeletal soils)**—An azonal group of soils having no clearly expressed soil morphology and consisting of a freshly and imperfectly weathered mass of

rock fragments; largely confined to steeply sloping land. Litho is from the Greek for rock. (See Azonal soil; Morphology, soil).

LOAM SOIL—See Texture.

MANGUM TERRACE—See Terrace.

MARL—An earthy crumbling deposit consisting chiefly of calcium carbonate mixed with clay or other impurities in varying proportions. It is used frequently as an amendment for soils deficient in lime.

MATURE SOIL—A soil with well-developed characteristics produced by the natural processes of soil formation, and in equilibrium with its environment.

MEDITERRANEAN CLIMATE—See Climate.

MELLOW SOIL—A soil that is easily worked or penetrated.

MESOPHYTIC VEGETATION—Vegetation that grows under medium conditions of atmospheric or soil moisture, as contrasted with xerophytic vegetation, able to withstand periodic or permanent conditions of low moisture; hydrophytic or aquatic vegetation; and halophytic vegetation, able to grow in soil of abnormally high salt content.

METAMORPHIC (OR METAMORPHOSED) ROCK—A rock the constitution of which has undergone pronounced alteration. Such changes are generally effected by the combined action of pressure, heat, and water, frequently resulting in a more compact and more highly crystalline condition of the rock. Gneiss, schist, and marble are common examples.

MICROCLIMATE—Local climatic conditions, brought about by the modification of general climatic conditions by local differences in elevation and exposure.

MICRORELIEF—Minor surface configurations, such as low mounds or shallow pits.

MINERAL SOIL—A general term used in reference to any soil composed chiefly of mineral matter.

MOBILE SOIL COLLOIDS—Soil colloids sufficiently dispersed that they may move in the soil with the percolating waters. (See Colloid, soil.)

MORPHOLOGY, SOIL—The physical constitution of the soil including the texture, structure, porosity, consistence, and color of the various soil horizons, their thickness, and their arrangement in the soil profile. (See Horizon, soil; Profile.)

MOTTLED (mottling)—Irregularly marked with spots of different colors.

MUCK—Fairly well decomposed organic soil material, relatively high in mineral content, dark in color, and accumulated under conditions of imperfect drainage.

MULL—A type of organic surface horizon of forested soils in which the organic matter is well decomposed and largely humus, granular in structure, relatively rich in bases, and medium acid to slightly alkaline in reaction. (See Horizon, soil; Humus; Reaction, soil.)

NEUTRAL SOIL—A soil that is not significantly acid or alkaline; strictly one having a pH of 7.0; practically, one having a pH between 6.6 and 7.3. (See Reaction, soil.)

NICHOLS TERRACE—See Terrace.

NITRIFICATION—Formation of nitrates from ammonia as in soils by soil organisms.

NITROGEN FIXATION—The conversion of atmospheric (free) nitrogen to nitrogen compounds. In soils, the assimilation of free nitrogen from the air by soil organisms (making the nitrogen eventually available to plants). Nitrogen-fixing organisms associated with plants such as the legumes are called symbiotic; those not definitely associated with plants are called nonsymbiotic.

NONCALCAREOUS—Free from calcium carbonate.

\*NONCALCIC BROWN SOILS—The zonal group of soils with slightly acid light-pinkish or light reddish-brown A horizons over light reddish-brown or dull-red B horizons developed under mixed grass and forest vegetation in a subhumid wet-dry climate. (See Horizon, soil; Zonal soil.)

NORMAL SOIL—A soil having a profile in equilibrium with the two principal forces of the environment—native vegetation and climate—usually developed on the gently undulating (but not strictly level) upland, with good drainage, from any parent material, not of extreme texture or chemical composition, that has been in place long enough for biological forces to exert their full effect. (See Parent material; Profile.)

NUT STRUCTURE—See Structure, soil.

**NUTRIENTS, PLANT**—The elements taken in by the plant, essential to its growth, and used by it in the elaboration of its food and tissue. These include nitrogen, phosphorus, calcium, potassium, magnesium, sulphur, iron, manganese, copper, boron, zinc, and perhaps others obtained from the soil; and carbon, hydrogen, and oxygen, obtained largely from the air and water.

**OCEANIC CLIMATE**—See Climate.

**\*ORDER (soil classification)**—The highest category in soil classification. The three orders are zonal, intrazonal, and azonal soils (defined elsewhere in the glossary) in the system of classification outlined in this Yearbook. (See Category.)

**ORGANIC SOIL**—A general term used in reference to any soil the solid part of which is predominantly organic matter.

**ORTERDE**—See Ortstein.

**ORTSTEIN**—Hard, irregularly cemented, dark-yellow to nearly black sandy material formed by soil-forming processes in the lower part of the solum. Similar material not firmly cemented is known as orterde. (See Solum.)

**OXIDE**—A compound of any element with oxygen alone.

**OXIDATION**—Any chemical change involving the addition of oxygen or its chemical equivalent. More technically, any chemical change involving an increase of positive or a decrease of negative valence.

**PARENT MATERIAL**—The unconsolidated mass from which the soil profile develops. (See Profile.)

**PARENT ROCK**—The rock from which parent materials of soils are formed. (See Parent materials.)

**PEAT**—Unconsolidated soil material consisting largely of undecomposed or slightly decomposed organic matter accumulated under conditions of excessive moisture.

**PEDALFER**—A term introduced by Marbut for a soil in which there has been a shifting of alumina and iron oxide downward in the soil profile but with no horizon of carbonate accumulation. Roughly equivalent to "soils of the humid regions." Derived from terms meaning soil, aluminum, iron. (See Carbonate accumulation; Horizon, soil; Profile.)

**PEDOCAL**—A term introduced by Marbut for a soil with a horizon of accumulated carbonates in the soil profile. Roughly equivalent to "soils of the arid and semiarid regions." Derived from terms meaning soil, calcium. (See Carbonate accumulation; Horizon, soil; Profile.)

**PEDOGENIC PROCESSES**—Processes of soil formation.

**PEDOLOGIC (pedological)**—Pertaining to pedology or soil science.

**PEDOLOGIST**—One versed in pedology; a soil scientist.

**PEDOLOGY**—The science that treats of soil; soil science. *Pedo* is from the Greek for ground or earth. The term is used commonly for the more fundamental aspects of soil science, whereas the term *agronomy* is used sometimes for the applied phases of the subject. In the United States, the term "*agronomy*" is used frequently to cover the applied phases of both soil science and the several plant sciences dealing with crops. This use of *agronomy* is so broad as to be somewhat confusing, however, and more and more this term is being confined to the applied phases of the plant sciences dealing with crops. The term "*edaphology*" has been used by some as an approximate equivalent to soil science and by others to cover plant-soil relationships. Although it is not widely used, one of its derivatives, *edaphic*, is used by ecologists as a general term for soil influences or conditions. (See Ecology; Edaphology.)

**PELITE**—A general name for rocks composed of fine particles of clay or mud, such as clay and shale.

**PENEPLAIN**—A land surface reduced by erosion almost to base level so that most of it is approximately a plain. In physiography the term "*peneplain*" is applied to old land surfaces which were formerly reduced almost to base level and subsequently raised bodily to a higher level, and which may or may not have been again intersected by streams. Where intersected, the old peneplain surface is represented by remaining flat hilltops, and in many places it is possible to trace remains of several different peneplain levels. *Pene* is from the Latin for almost.

**pH**—A notation introduced by Sorensen to designate relatively weak acidity and alkalinity, such as is encountered in soils and biological systems. Tech-

nically, the common logarithm of the reciprocal of the hydrogen-ion concentration of a system. A pH of 7.0 indicates precise neutrality, higher values indicate alkalinity, and lower values acidity. (See Reaction, soil.)

**PHASE, SOIL**—That part of a soil unit or soil type having minor variations in characteristics used in soil classification from the characteristics normal for the type, although they may be of great practical importance. The variations are chiefly in such external characteristics as relief, stoniness, or accelerated erosion.

\***PLANOSOL**—An intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils, developed upon nearly flat upland surface under grass or forest vegetation in a humid or subhumid climate. (See Eluviation; Horizon, soil; Intrazonal soil.)

**PLASTIC**—Capable of being molded or modeled without rupture; not friable.

**PLATY**—See Structure, soil.

**POCOSIN**—A local term for a swamp, usually containing more or less peat, characteristic of southeastern United States.

**PODZOL SOILS**—A zonal group of soils having an organic mat and a very thin organic-mineral layer above a gray leached layer which rests upon an illuvial dark-brown horizon, developed under the coniferous or mixed forest, or under heath vegetation in a temperate to cold moist climate. Iron oxide and alumina, and sometimes organic matter, have been removed from the A and deposited in the B horizon. From the Russian for like, or near, ash. (See Eluviation; Horizon, soil; Leaching; Zonal soil.)

**PODZOLIC SOILS**—Soils that have been formed wholly or partly under the influence of the podzolization process.

**PODZOLIZATION**—A general term referring to that process (or those processes) by which soils are depleted of bases, become acid, and have developed eluvial A horizons (surface layers of removal) and illuvial B horizons (lower horizons of accumulation). Specifically the term refers to the process by which a Podzol is developed, including the more rapid removal of iron and alumina than of silica, from the surface horizons, but it is also used to include similar processes operative in the formation of certain other soils of humid regions. (See Eluviation; Horizon, soil; Podzol soils.)

**POROSITY, SOIL**—The degree to which the soil mass is permeated with pores or cavities. It is expressed as the percentage of the whole volume of the soil which is unoccupied by solid particles.

**PRAIRIE SOILS**—The zonal group of soils having a very dark brown or grayish-brown surface horizon, grading through brown soil to the lighter colored parent material at 2 to 5 feet, developed under tall grasses, in a temperate, relatively humid climate. The term has a restricted meaning in soil science and is not applied to all dark-colored soils of the treeless plains but only to those in which carbonates have not been concentrated in any part of the profile by the soil-forming processes. (See Horizon, soil; Profile; Zonal soil.)

**PRECIPITATION-EFFECTIVENESS (P-E) INDEX**—The sum of the 12 monthly quotients of precipitation divided by evaporation. (See Thornthwaite, 402a, 402b.)<sup>2</sup>

**PRISMATIC**—See Structure, soil.

**PRODUCTIVITY (of soil)**—The capability of a soil for producing a specified plant or sequence of plants under a specified system of management.

**PROFILE, SOIL**—A vertical section of the soil through all its horizons and extending into the parent material. (See Horizon, soil; Parent material.)

**REACTION, SOIL**—The degree of acidity or alkalinity of the soil mass expressed in pH values, or in words as follows:

pH		pH	
Extremely acid.....	Below 4.5	Neutral <sup>3</sup> .....	6.6-7.3
Very strongly acid.....	4.5-5.0	Mildly alkaline.....	7.4-8.0
Strongly acid.....	5.1-5.5	Strongly alkaline.....	8.1-9.0
Medium acid.....	5.6-6.0	Very strongly alkaline.....	9.1 and higher
Slightly acid.....	6.1-6.5		

<sup>2</sup> Italic numbers refer to Literature Cited, p. 1181.

<sup>3</sup> Strict neutrality is precisely pH 7.0. Very few actual soil samples have this value and those having pH values between 6.6 and 7.3 are considered, for all practical purposes, neutral. For more precise identification, those between 6.6 and 7.0 may be described as very slightly acid and those between 7.0 and 7.3 as very mildly alkaline.



- \*REDDISH BROWN SOILS**—A zonal group of soils with a light-brown surface horizon of a slightly reddish cast, which grades into dull reddish-brown or red material heavier than the surface soil, thence into a horizon of whitish or pinkish lime accumulation. Developed under shrub and short-grass vegetation of warm-temperate to tropical regions of semiarid climate. (See Horizon, soil; Zonal soils.)
- RED DESERT SOIL**—A zonal group of soils having light reddish-brown friable soil over a reddish-brown or dull-red heavy horizon grading into an accumulation of carbonate of lime; found in warm-temperate and tropical deserts and characterized by more or less scant desert-shrub vegetation. (See Carbonate accumulation; Horizon, soil; Zonal soils.)
- \*REDDISH-BROWN LATERITIC SOILS**—A zonal group of soils with dark reddish-brown granular surface soils, red friable clay B horizons, and red or reticulately mottled lateritic parent material; developed under humid tropical climate with wet-dry seasons and tropical forest vegetation. (See Horizon, soil; Lateritic soils; Parent material; Zonal soil.)
- \*REDDISH CHESTNUT SOILS**—A zonal group of soils with dark-brown, tinted pinkish or reddish surface soils up to 2 feet thick over heavier reddish-brown soil over grayish or pinkish lime accumulation; developed under warm-temperate semiarid climate and mixed grass vegetation with some shrubs. Approximately equivalent to southern Chernozem. (See Chernozem soils, Zonal soil.)
- \*REDDISH PRAIRIE SOILS**—A zonal group of soils with dark reddish-brown, slightly to medium acid surface soils grading through somewhat heavier reddish material to the parent material; developed under warm-temperate humid to subhumid climate and tall-grass vegetation. (See Parent material; Zonal soil.)
- \*RED PODZOLIC SOILS**—A zonal group of soils having thin organic and organic-mineral layers over a yellowish-brown leached layer which rests upon an illuvial red horizon; developed under a deciduous or mixed forest in a warm-temperate moist climate. Equivalent to Red soils. (See Eluviation; Leaching; Horizon, soil; Zonal soil.)
- REDUCTION**—Any chemical change involving the removal of oxygen or its chemical equivalent. More technically, any chemical change involving a decrease of positive or an increase of negative valence.
- REGIONAL PROFILE (soil)**—A soil profile that owes its character largely to the effects of the climate and vegetation normal for the region in which it has formed. The mature normal soil characteristic of a given soil region. (See Profile.)
- RELIEF**—The elevations or inequalities of a land surface, considered collectively.
- RENDZINA SOILS**—An intrazonal group of soils, usually with brown or black friable surface horizons underlain by light-gray or yellowish calcareous material; developed under grass vegetation or mixed grasses and forest, in humid and semiarid regions from relatively soft, highly calcareous parent material. From a Polish peasant term for productive calcareous soils. (See Horizon, soil; Intrazonal soil; Parent material.)
- RESIDUAL OR SEDENTARY MATERIAL**—Soil material presumably developed from the same kind of rock as that on which it lies. The term "residual" is sometimes incorrectly applied to soils.
- RETICULATE MOTTLING**—A network of coarse streaks of different colors in soils or parent materials; applied especially to lateritic materials and Laterite. Sometimes called vermiculate mottling. (See Laterite soils; Parent material.)
- RILL EROSION**—See Erosion.
- SALINE SOIL**—A soil containing an excess of soluble salts, more than approximately 0.2 percent, not excessively alkaline, pH less than 8.5; approximately equivalent to Solonchak. (See Solonchak.)
- SALT**—The product, other than water, of the reaction of a base with an acid.
- SAND**—Small rock or mineral fragments having diameters ranging from 1 to 0.05 mm; coarse sand, 1 to 0.5; sand, 0.5 to 0.25; fine sand, 0.25 to 0.1; very fine sand, 0.1 to 0.05. The term "sand" is also applied to soils containing 90 percent or more of all grades of sand combined. Although usually made up chiefly of quartz, sands may be composed of any materials or mixtures of mineral or rock fragments.

SCABLAND—See Land.

SCORIA—A slaglike clinker deposit characteristic of burned-out coal beds, especially in the western Great Plains. The term "scoria" is also applied to slaglike lava deposits.

SECOND BOTTOM—The first terrace level of a stream valley lying above the flood plain, rarely or never flooded. (See First bottom; Flood plain.)

SEDIMENTARY ROCK—A rock composed of particles deposited from suspension in water. The chief groups of sedimentary rocks are (1) conglomerates (from gravels), (2) sandstones (from sands), (3) shales (from clays), and (4) limestones (from calcium carbonate deposits); but there are many intermediate types.

SEMIARID CLIMATE—See climate.

SERICITIC PHYLITE—A phyllite containing a large proportion of the scaly variety of muscovite mica known as sericite.

SERIES, SOIL—A group of soils having genetic horizons similar as to differentiating characteristics and arrangement in the soil profile, except for the texture of the surface soil, and developed from a particular type of parent material. A series may include two or more soil types differing from one another in the texture of the surface soils. (See Horizon, soil; Parent material; Profile; Type, soil.)

SHEET EROSION—See Erosion.

SIEROZEM SOILS—A zonal group of soils having a brownish-gray surface horizon that grades through lighter colored material into a layer of carbonate accumulation and frequently into a hardpan layer, developed under mixed shrub vegetation in a temperate to cool arid climate. From the Russian for gray earth. (See Carbonate accumulation; Hardpan; Horizon, soil.)

SILICA-ALUMINA RATIO (in soils and colloids)—Since equal weights of substances are not equal in chemical value, in order to compare chemically the quantities of substances found by analyses of soils or of their colloids, it is customary to divide the actual weights (or the percentage amounts) of substances by their formula weight, in order to obtain the relative number of chemical units. These relative quantities may then be expressed as a ratio. If then, in a colloid, the quantities of silica and of alumina are found to be 30.90 and 32.58, then the silica-alumina ratio is—

$$\frac{\begin{array}{r} 30.90 \\ 60.3 \\ \hline 32.58 \\ 102.2 \end{array}}{102.2} = 1.61$$

This means that in this colloid there are 1.61 units of silica as compared with 1 of alumina. Usually, ratios of this sort are more useful in the study of soil colloids than of soils. This apparently irregular method of expression of the relative chemical units in soil colloids is due to the fact that these colloids are complex mixtures of a variety of compounds, and therefore the ordinary mode of expression of chemical composition by formulas is impossible.

SILICA-SESQUIOXIDE RATIO—If the analysis of a soil colloid shows the presence of 44.86 silica, 7.40 iron oxide, and 22.04 alumina, then the silica-sesquioxide ratio is found as follows:

$$\begin{array}{r} 44.86 \div 60.3 = 0.7440 \\ 7.40 \div 159.7 = 0.0463 \\ 22.04 \div 102.0 = 0.2161 \end{array}$$

The quotients represent the relative chemical unit quantities of these three substances in this colloid. If 0.744 is divided by the sum of 0.0463 and 0.2161, the quotient is 2.84, the silica-sesquioxide ratio. This means that for each unit of the alumina and iron oxide, taken together, there are 2.84 units of silica. The two oxides, alumina ( $\text{Al}_2\text{O}_3$ ) and iron oxide ( $\text{Fe}_2\text{O}_3$ ), are the only two oxides in soils, in any considerable quantity, in which the elements are present in the ratio of 2 to 3, or 1 to  $1\frac{1}{2}$ ; hence the term sesquioxide. (See Silica-alumina ratio.)

SILT—Small mineral soil grains the particles of which range in diameter from 0.05 to 0.002 mm (or 0.02–0.002 mm in the international system). (Formerly 0.05–0.005 mm.)

**SKELETAL SOILS**—Equivalent to Lithosols.

**SOIL**—The natural medium for the growth of land plants on the surface of the earth. A natural body on the surface of the earth in which plants grow, composed of organic and mineral materials.

**SOIL CLIMATE**—Moisture and temperature conditions within the soil.

**SOIL MAP**—A representation designed to portray the distribution of soil types, phases, and complexes as well as other selected cultural and physical features of the earth's surface necessary for convenience in its use.

*Detailed*—The boundaries of soil types and phases are plotted upon the base map from precisely located points and from observations made throughout their course in sufficient detail to indicate those differences of significance in the use of the land.

*Reconnaissance*—The boundaries between the soil types and phases are plotted from observations made at intervals.

*Detailed-reconnaissance*—A map having parts constructed according to the requirements of the detailed soil map and parts according to the less rigid requirements of the reconnaissance soil map. (See Complex; Phase; Type.)

**SOIL SURVEY REPORT**—A written report accompanying a soil map describing the area surveyed, the characteristics and capabilities for use of the soil types and phases shown on the map, and the principal factors responsible for soil development. (See Phase; Type.)

**SOLODIZED SOIL**—A soil that has been subjected to the processes responsible for the development of a Soloth and having at least some of the characteristics of a Soloth. (See Soloth soils.)

**SOLONCHAK SOILS**—An intrazonal group of soils having a high concentration of soluble salts; usually light colored; without characteristic structural form; developed under salt-loving grass or shrub vegetation mostly in an arid, semiarid, or subhumid climate. From the Russian for salt. (See Intrazonal soil.)

**SOLONETZ SOILS**—An intrazonal group of soils having a variable surface horizon of friable soil underlain by dark hard soil, ordinarily with columnar structure; usually highly alkaline; developed under grass or shrub vegetation, mostly in a subhumid or semiarid climate. From the Russian for salt. (See Horizon, soil; Intrazonal soil; Structure, soil.)

**SOLOTH SOILS**—An intrazonal group of soils having a thin surface layer of brown friable soil above a gray leached horizon which rests upon a brown or dark-brown horizon; developed under shrubs, grasses, or mixed grasses and trees usually in a semiarid or subhumid climate. From the Russian for salt. Solodi or Solodee, plural forms, also are used. (See Horizon, soil; Intrazonal soil; Leaching.)

**SOLUM**—The upper part of the soil profile, above the parent material, in which the processes of soil formation are taking place. In mature soils this includes the A and B horizons, and the character of the material may be, and usually is, greatly unlike that of the parent material beneath. Living roots and life processes are largely confined to the solum. (See Horizon, soil; Parent material.)

**STRATIFIED**—Composed of, or arranged in, strata or layers, as stratified alluvium. The term is applied to geological materials. Those layers in soils that are produced by the processes of soil formation are called horizons, while those inherited from the parent material are called strata.

**STRIP CROPPING**—Strip cropping is a practice of growing ordinary farm crops in long strips of variable widths, across the line of slope, approximately on the contour, on which dense-growing crops are seeded in alternate strips with clean-tilled crops.

**STRUCTURE, SOIL**—The morphological aggregates in which the individual soil particles are arranged. The following are the principal types of soil structure:

*Prismatic*—Blocky structure with the vertical axis of the blocks longer than the horizontal, as in the B horizon of many Chestnut soils.

*Nutlike*—Blocky structure, angular, as in the B horizon of the Gray-Brown Podzolic soils, or rounded, as in the B horizon of many Chernozems.

*Columnar*—Prismatic with rounded tops, as in the B horizon of the solodized-Solonetz.

*Platy*—Thin horizontal plates, as in the A<sub>2</sub> horizons of the Podzol and the solodized-Solonetz.

*Crumb*—Generally soft, small, porous aggregates, irregular in shape, as in the A<sub>1</sub> horizons of many soils.

*Granular*—Hard or soft but firm small aggregates, angular or rounded, as in the A horizon of many Chernozems.

*Fragmental*—Hard or soft but firm irregular aggregates, angular or subangular, as in many young soils developed from silty or clayey alluvium.

\**Phylliform*—Thin leaflike layers, less distinct and thinner than platy. Where this condition is confined to inherited layers, as in the C horizon of soils developed from thin-bedded sediments, the term laminated is used.

To indicate a lack of definite structure, the following terms are normally used: *Single grain*—Each grain by itself, as in dune sand (structureless).

*Massive*—Large uniform masses of cohesive soil, sometimes with irregular cleavage, as in the C horizons of many heavy clay soils (structureless).

(See Aggregate; Alluvium; Chernozem soils; Gray-Brown Podzolic soils; Horizon, soil; Morphology; Solodized; Solonetz soils.)

SUBHUMID CLIMATE—See Climate.

\*SUBORDER (soil classification)—The second highest category in soil classification, including the main groups of great soil groups. (See Category; Great soil groups.)

SUBSOIL—Roughly, that part of the solum below plow depth. (See Solum.)

SURFACE SOIL—That part of the upper soil of arable soils commonly stirred by tillage implements or an equivalent depth (5 to 8 inches) in nonarable soils.

SYMBIOTIC—See Nitrogen fixation.

TALUS—Fragments of rock and soil material collected at the foot of cliffs or steep slopes, chiefly as a result of gravitational forces.

TERRACE (for control of run-off, or soil erosion, or both)—A broad surface channel or embankment constructed across the sloping lands, on or approximately on contour lines, at specific intervals. The terrace intercepts surplus run-off, to retard it for infiltration or to direct the flow to an outlet at nonerosive velocity.

Types of terraces:

*Absorptive*—A ridge type of terrace used primarily for moisture conservation. It is adapted to low slopes and absorptive soils. A Mangu terrace is a broad-based ridge type, named for the man who first designed it.

*Bench*—A terrace approximately on the contour, having a steep or vertical drop to the slope below, and having a horizontal or gentle sloping part which is farmed. It is adapted to the steeper slopes.

*Drainage*—A broad channel-type terrace used primarily to conduct water from the field at a low velocity. It is adapted to less absorptive soil and regions of high rainfall. A Nichols terrace is a broad-channel type named after the man who first designed it.

TERRACE (geological)—A flat or undulating plain, commonly rather narrow and usually with a steep front, bordering a river, a lake, or the sea. Many streams are bordered by a series of terraces at different levels, indicating the flood plains at successive periods. Although many older terraces have become more or less hilly through dissection by streams, they are still regarded as terraces.

TEXTURE, SOIL—The relative proportion of the various size groups of individual soil grains.

*Soil separates*—The individual size groups of soil particles, such as sand, silt, and clay.

*Soil class*—Classes of soil based on the relative proportion of soil separates. The principal classes, in increasing order of the content of the finer separates, are as follows: Sand, loamy sand, sandy loam, loam, silt loam, clay loam, and clay. These may be modified according to the relative size of the coarser particles to fine sand, loamy fine sand, fine sandy loam, very fine sandy loam, coarse sandy loam, gravelly sandy loam, gravelly loam, cobbly loam, sandy clay, stony clay, silty clay, stony loam, etc.

TILL (glacial)—A deposit of earth, sand, gravel, and boulders transported by glaciers. Till is unstratified.

TILL PLAIN—A level or undulating land surface covered by glacial till.

TILTH—The physical condition of a soil in respect to its fitness for the growth of a specified plant.

TOPSOIL—A general term applied to the surface portion of the soil, including the

- average plow depth (surface soil) or the A horizon, where this is deeper than plow depth. It cannot be precisely defined as to depth or productivity except in reference to a particular soil type.
- TRANSITIONAL SOIL**—Soil that does not clearly belong to any important soil group or series with which it is associated, but has some properties of each.
- TRANSPORTED SOIL MATERIALS**—Parent materials of soils that have been moved from the place of their origin and redeposited during the weathering process itself or during some phase of that process, and which consist of, or are weathered from, unconsolidated formations.
- TROCKENTORF**—A peatlike deposit, relatively undecomposed, found on the surface of well-drained soils under forest cover, and composed of the remains of leaves and fragments of wood. From the German for dry turf.
- TRUNCATED SOIL PROFILE**—A soil profile that has had a part of the solum removed by accelerated erosion. (See Solum.)
- TUFF (tufa)**—A rock composed of the finer kinds of volcanic detritus, usually more or less stratified and in various states of consolidation. There are many varieties. Tufa applies to similar rocks, but more especially to a kind of porous rock formed as a deposit from springs or streams; usually applied to calcareous deposits (travertine) in the phrase, "calcareous tufa." (See Detritus.)
- TUFFACEOUS**—Of, pertaining to, or like tuff.
- TUNDRA SOILS**—A zonal group of soils having dark-brown highly organic layers over grayish horizons which rest on an ever-frozen substratum; developed under shrubs and mosses in cold, semiarid to humid climates, i. e., in Arctic regions. (See Horizon, soil; Zonal soil.)
- TYPE, SOIL**—A group of soils having genetic horizons similar as to differentiating characteristics, including texture and arrangement in the soil profile, and developed from a particular type of parent material. (See Horizon, soil; Parent material; Profile.)
- UNCONSOLIDATED (soil material)**—Soil material in a form of loose aggregation.
- VARNISH, DESERT**—A glossy coating of dark-colored compounds, probably composed largely of iron oxides, covering pebbles, stones, and large rock surfaces exposed in hot deserts.
- VERTICAL ZONALITY OF SOILS**—The distribution of different great soil groups on mountain slopes, each group occupying a definite climatic and vegetation zone. (See Great soil group.)
- VESICULAR STRUCTURE**—Soil structure characterized by round or egg-shaped cavities or vesicles.
- WASTE LAND**—See Land.
- WATER TABLE**—The upper limit of the part of the soil or underlying material wholly saturated with water.
- WEATHERING**—The physical and chemical disintegration and decomposition of rocks and minerals.
- WET CLIMATE**—See Climate.
- WET-DRY CLIMATE**—See Climate.
- WIESENBODEN (Meadow soils)**—An intrazonal group of soils with dark-brown or black soil high in organic matter grading at 6 to 30 inches into gray soil; developed under grasses and sedges, mostly in a humid or subhumid climate. (See Intrazonal soils.)
- \*YELLOW PODZOLIC SOILS**—A zonal group of soils having thin organic and organic-mineral layers over a grayish-yellow leached layer which rests on a yellow horizon; developed under the coniferous or mixed forest in a warm-temperate moist climate. Equivalent to Yellow soils.
- \*YELLOWISH-BROWN LATERITIC SOILS**—A zonal group of soils characterized by yellowish-brown friable and granular surface horizons high in clay content over yellow or reddish-yellow friable clay material overlying parent materials usually not strongly mottled. Developed under tropical forest in hot, humid to subhumid, wet-dry climate. (See Horizon, soil; Parent material; Zonal soil.)
- XEROPHYTIC VEGETATION**—Vegetation characteristic of the desert regions; thorny brush, cacti, shrubs, and small flowering annual and perennial plants.

**ZONAL SOIL**—Any one of the great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms, chiefly vegetation. In the United States these groups include the following (defined elsewhere in this glossary): Tundra, Podzol, Brown Podzolic, Gray-Brown Podzolic, Red and Yellow Podzolic, Yellowish-Brown and Reddish-Brown Lateritic, Laterite, Prairie, Reddish Prairie, Noncalcic Brown, Degraded Chernozem, Chernozem, Chestnut, Reddish Chestnut, Brown, Reddish Brown, Sierozem, Desert, and Red Desert soils. (See Great soil groups.)

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# Index

	Page		Page
Abilene soil area, description	1087-1088	Agriculture—Continued.	
ABLEITER, J. K.—		relation to—	
Soil Maps and Their Use	1002-1015	economic instability	187-189
The Soil Requirements of Economic Plants.		soil-erosion problem	581-608
With M. F. Morgan and J. H. Gourley	753-776	Agronomy, extension agents, work	199-200, 201
Acidity, reaction in soils, importance	755	Aiken soil area, description	1058
Acids—		Alabama Agricultural Experiment Station,	
exchange in soils, value	579	experiments with green manures	439
formation in soils	579-580	Alabama Extension Service, work with winter	
true, cause of soil acidity	578-579	legumes	200
Acreage, instability, examples	172	Alamance soil area, description	1064, 1065
Actinomycetes, activity in soil	944	Alaska—	
Adsorption theory of soil acidity	577, 578	Fairbanks soil area, description	1149-1151
Aeration, adequate, requirement of soils	754	Gilmore soil area, description	1149-1151
Aerobes, activity in soil	942	grassland area, description	1151
Agents, county. <i>See</i> County Agents.		Knik soil area, description	1148, 1149
Agricultural—		Muskeg soil area, description	1148, 1149
adjustment program, discussion	305-311	soils of, description	1148-1151
conservation—		Tanana soil area, description	1149-1151
program, policies	311-312	tundra area, description	1151
programs, 1936-38	281, 282	ALBRECHT, WILLIAM A.: Loss of Soil Organic	
finance—		Matter and Its Restoration	347-360
changes, remedies. Donald Jackson, R.		Alderwood soil area, description	1036
Clifford Hall, Roy M. Green, and		ALEXANDER, L. T.: The Physical Nature of	
David L. Wickens	265-278	Soil. With T. D. Rice	887-896
imperfections, cause of soil misuse. David		Alfalfa—	
L. Wickens, R. Clifford Hall, and		harvested, nitrogen content	371
Donald Jackson	158-170	potash content	399
income. <i>See</i> Income, agricultural.		residual effect of phosphate fertilizer	391, 392
prices. <i>See</i> Prices, agricultural.		soil requirements	763, 764
production—		stage of maturity and cuttings, effect on	
instability	171-175	calcium and phosphorus content	787, 788
reaction to decline in consumer buying		value as cover crop	440, 443
power	196	Alkali, problem in soil under irrigation	710-715
unbalance with industrial production	191-197	ALLIN, BUSHROD W.—	
products—		Public Purposes in Soil Use. With Carl C.	
domestic demand, instability, effects	176-179	Taylor and O. E. Baker	47-59
foreign trade, instability, characteristics	175, 176	The Remedies: Economic Stabilization.	
storage stocks, instability, effects	173-175	With O. V. Wells	289-295
techniques, simple and social	867-869	Alluvial soils. <i>See</i> Soils, alluvial.	
Agricultural Adjustment Act—		Alpine Meadow—	
crop control provisions	280-281, 282	soil areas, description	1124, 1125
of 1938, provisions	312, 313	soils—	
provisions for crop adjustments	290-292	characteristics, environment, and use	1000
spending, limitation fixed by Supreme		classification	994
Court	306-308	formation	975
three-point farm program	18, 19	Altamont soil area, description	1052, 1053
Agricultural Adjustment Administration—		Aluminum—	
aid to farmers by benefit-payment program	283	effects on plant development	812, 813
benefits	128	phosphate, availability to plants	387, 388, 389
field work by State extension agents	204-205	Amarillo soil area, description	1085
land-use adjustment projects	235	Amity soil area, description	1050, 1051
Agricultural Conservation and Domestic Al-		Ammo-Phos, description and value as fertilizer	
lotment Act, conservation program	205	material	507
Agriculture—		Ammonia—	
balance with industry	10-11	absorption and transformations in soil	943
benefits from—		compounds, characteristics as fertilizer ma-	
reclamation projects	256-259	terials	493
rural resettlement program	253-256	solutions, commercial, composition	528
competition with business	191-197	use as fertilizer material	506
conservation through cooperative grazing		utilization by plants	373
associations	247, 248	Ammoniates, organic—	
fluctuations in, effect on soil misuse	10	use as fertilizer materials	493-495
instability in, effect on soil misuse	10	value	462, 497, 498
post-war recovery and later maladjust-		Ammoniation of fertilizer mixtures, proc-	
ment	185-187	esses	526-528

	Page		Page
Ammonium—		Barley—	
chloride, description and value as fertilizer material	507	chemical composition—	
compounds, fertilizer value	497	changes, relation to water supply	793
nitrate, description and value as fertilizer material	507	influence of different fertilizer treatments	798
phosphates—		harvested, nitrogen content	371
description and value as fertilizer materials	508	scab, control effect of tillage	325, 326
See also Ammo-Phos.		soil requirements	756-757
sulphate—		BARNES, C. P.—	
description and value as fertilizer material	508	The Problem: Land Unfit for Farming in the Humid Areas	60-67
use in mixed fertilizers	536-538	The Remedies: Education and Research. With C. W. Warburton, C. B. Manifold, and Charles E. Kellogg	198-222
Anaerobes, activity in soil	942, 943	Barnes soil area, description	1075-1076
ANDERSON, M. S.—		Base line, establishing for strip-cropping system	643
Determining the Fertilizer Requirement of Soils. With Oswald Schreiner	469-486	Bates soil area, description	1056
Formation of Soil. With H. G. Byers, Charles E. Kellogg, and James Thorp	948-978	Baxter soil area, description	1058-1059, 1062
General Chemistry of the Soil. With Horace G. Byers and Richard Bradfield	911-928	BEAN, LOUIS H.: The Causes: Price Relations and Economic Instability. With J. P. Cavin and Gardiner C. Means	171-197
Animal—		Bean blight, control by rotations	415
development, effect of neglected soil constituents. J. E. McMurtrey, Jr., and W. O. Robinson	807-829	Beans—	
life, soil relationships	777-779	dry, soil requirements	764
nutrition, major elements—		field, fertilizer application, recommendations	562
in some soil relationships. C. A. Browne	777-806	lima, yields, effect of fertilizing methods	549, 550
relation to soil deficiencies	801-806	soil requirements	775
Animals—		Bearden soil area, description	1077
burrowing, effect upon soil	946, 947, 964, 965	Beauregard soil area, description	1060, 1061
farm, excrements, amount and composition	449, 450	Beech, indicator of soil series	840, 841
gains under light grazing of pastures	617-619	Beets, potash content	399
See also Livestock.		Benefit payments, unconstitutionality	306, 308-311
Anthony soil area, description	1100, 1101	Benewah soil area, description	1038
Anthraxose of—		BENNETT, HUGH H.: General Aspects of the Soil-Erosion Problem. With W. C. Lowdermilk	581-608
beans, control by rotations	415	BENNETT, JOHN B.—	
cucumber, control by rotations	415	The Causes: Traditional Attitudes and Institutions. With L. C. Gray, Erich Kraemer, and W. N. Sparhawk	111-136
Antimony, effects on animal and plant development	813	The Problem: Subhumid Areas. With F. R. Kenney and W. R. Chapline	68-76
Apples, soil requirements	768	Berkshire soil area, description	1021, 1022
Applying soil area, description	1059, 1060	Bermuda grass, surface run-off on various soil types and land slopes	619, 620
Arid regions—		Berries—	
drainage practices. James Thorp and C. S. Scofield	717-722	soil requirements	769-771
soils, classification	993	See also under specific kinds.	
Arsenic, effects on animal and plant development	813, 814	Beryllium, effects on plant development	814
Ash areas, volcanic, of Hawaiian Islands, description	1161	Bethel soils, development	968
Ash content, of various crops, analyses	781, 782	Bing ham soil area, description	1081
Ash soil area, description	1045, 1046	Birch, indicator of soil series	840-841
Asparagus, soil requirements	773, 774	Blackberries, soil requirements	769
<i>Aspergillus niger</i> , use to determine fertilizer needs of soil	944	Bladen soil area, description	1110-1112, 1113-1115
Austin soil area, description	1107, 1108	Blanton soil area, description	1068, 1069
AUTEN, JOHN T.: Management of Forest Soils. With Ivan H. Sims and E. N. Munns	737-750	Blood, dried, value and use as fertilizer material	509
Avalanches, agent in weathering rocks	956	Blueberries, soil requirements	769, 770
Avon soil area, description	1081	Bluejoint sod, indicator of soil series	843, 844
<i>Azotobacter</i> , importance in fixation of nitrogen	943, 944	Bluestem, indicators of soil series	847
Babb soil area, description	1126, 1127	Bog—	
Baca soil area, description	1089	soil areas—	
Bacteria, in soil—		description	1128-1133
chemical composition	965	in Puerto Rico, description	1147
counting, methods and accuracy	941, 942	soils—	
fixation of nitrogen	943, 944, 965	characteristics, environment, and use	1000
functions and activity	942, 943	classification	994
kinds	942-944	formation and characteristics	975
value	42	of Hawaiian Islands, description	1159
Bainville soil area, description	1083, 1084	See also Muck.	
BAKER, O. E.: Public Purposes in Soil Use. With Carl C. Taylor and Bushrod W. Allin	47-55	Bone products, preparation and use as fertilizer materials	512, 513
BALDWIN, MARK: Soil Classification. With Charles E. Kellogg and James Thorp	979-1001	Bonemeal, fertilizer value	503-513
Bankhead-Jones Farm Tenant Act—		Bones, value as fertilizer material, and treatment	
farm mortgage provisions	277, 278		512, 513
provisions	14, 17, 239	Boone soil area, description	1034
Barium, effects on animal and plant development	814	Boron, effects on plant development	814-816
		Boyd soil area, description	1075
		BRADFIELD, RICHARD: General Chemistry of the Soil. With Horace G. Byers and M. S. Anderson	911-928
		Bridgeport soil area, description	1082, 1083
		Bromine, effects on plant development	817
		Brookston soil area, description	1040, 1041

	Page		Page
Broomsedge, indicator of soil series.....	844	CHAMBERS, T. B.: Mechanical Measures of Erosion Control. With M. L. Nichols.....	646-665
BROWN, B. E.—		Channels—	
Fertilizer Materials. With Oswald Schrein-		diversion, construction and use.....	648, 649, 657
er and Albert R. Merz.....	487-521	intermittent and continuous flow, uses.....	660-662
Soil Nitrogen. With Oswald Schrein.....	361-376	low- and high-velocity, construction and	
Soil Potassium in Relation to Soil Fer-		use.....	659, 660
tility. With H. P. Cooper and Oswald		types used for erosion control.....	658-662
Schrein.....	397-405	water, protection from erosion.....	32
Brown soils—		Chaparral, indicator of soil series.....	854
characteristics, environment, and use.....	996	CHAPLINE, W. R.: The Problem: Subhumid	
classification.....	993	Areas. With John B. Bennett and F. R.	
description.....	970, 971, 1088-1092	Kenney.....	68-76
nitrogen content.....	366	Charlton soil area, description.....	1031, 1032
phosphorus content.....	381	Chemistry and Soils, Bureau of, Soil Survey	
Brown Forest soils—		Division: Soils of the United States.....	1019-1161
characteristics, environment, and use.....	1001	Chernozem soils—	
classification.....	996	alluvial, description.....	1135
nitrogen content.....	365	areas, description.....	1075-1080
Brown Podzolic soils—		characteristics, environment, and use.....	997
characteristics, environment, and use.....	998	classification.....	993
classification.....	994	description and regions.....	970, 971
description.....	1029-1033	humus, origin and content.....	937, 938
formation and characteristics.....	972, 973	nitrogen content.....	366
BROWNE, C. A.: Some Relationships of Soil to		phosphorus content.....	381
Plant and Animal Nutrition—The Major		See also Degraded Chernozem soils.	
Elements.....	777-806	Chernozemlike soils, nitrogen content.....	366
Buckwheat—		Cherries, soil requirements.....	768
chemical composition, effect of soil types.....	783	Cheshire soil area, description.....	1032, 1033
chemical composition, yields, and ash con-		Chester soils—	
tent, effect of cropping.....	784	area, description.....	1034, 1035
soil requirements.....	757	derivation.....	973
Buffalo grass—		Chestnut soils—	
indicators of soil series.....	846, 847	areas, description.....	1080-1088
sod, effect of contour listing on yields and		characteristics, environment, and use.....	996
moisture penetration.....	627	classification.....	993
Bunchgrass, indicator of soil series.....	844, 849	description and region.....	970, 971
Business cycles, effect on agriculture.....	187-189	nitrogen content.....	366
BYERS, H. G.—		China, soil classification.....	979
Formation of Soil. With Charles E. Kel-		Chipeta soil area, description.....	1098
logg, M. S. Anderson, and James Thorp.....	948-978	Chlorine, effects on animal and plant develop-	
General Chemistry of the Soil. With M. S.		ment.....	817
Anderson and Richard Bradfield.....	911-928	Chromium, effects on animal and plant devel-	
Cabbage, harvested, nitrogen content.....	371	opment.....	817, 818
Caddo soil area, description.....	1060, 1061	Cinder areas, of Hawaiian Islands, description.....	1161
Cadmium, effects on plant development.....	817	Citrus fruits, soil requirements.....	761
Caesium, effects on plant development.....	817	City, dependence on support by rural popula-	
Cal Nitro. See Ammonium nitrate.		tion.....	872, 873
Calcium—		Civil Works Administration, grants for relief.....	127
cyanamide—		Civilian Conservation Corps, cooperation with	
classification as fertilizer.....	495	farmer on soil-conservation plans.....	177, 283, 284, 287
description and use as fertilizer material.....	508	CLAPP, EARLE H.: The Remedies: Policies for	
nitrate, description and value as fertilizer		Public Lands. With E. N. Munns, I. H.	
material.....	508	Sims, George S. Wehrwein, and C. F. Clay-	
occurrence in fertilizers.....	504	ton.....	223-240
phosphate, availability to plants.....	387	Clarion soil area, description.....	1054, 1055
Calurea, description and value as fertilizer		Clarksville soil area, description.....	1061-1062, 1063, 1064
material.....	509	Clay, derivation and components.....	918, 919
Canfield silt loam, potash content.....	398	Clays, composition.....	951
Capulin soil area, description.....	1089, 1090	CLAYTON, C. F.: The Remedies: Policies for	
Carbon dioxide output of soil, amounts.....	349	Public Lands. With Earle H. Clapp, E. N.	
Caribou soil area, description.....	1022	Munns, I. H. Sims, and George S. Wehr-	
Carrington soil area, description.....	1053, 1054	wein.....	223-240
Carrots, potash content.....	399	Clermont soil area, description.....	1104
Castor pomace, description and value as fertil-		Climate, effect on—	
izer material.....	509	chemical composition of crops grown on same	
Catron soil area, description.....	1106, 1107	soil.....	788-792
Cattle—		plant composition.....	36, 37
diseases, relation to chemical composition of		soil formation.....	961-963
soils.....	803-806	Clinton soil area, description.....	1034
price fluctuations.....	182, 183	Clover—	
CAVIN, J. P.:—		crimson, value as cover crop.....	440, 441, 442
The Causes: Price Relations and Economic		harvested, nitrogen content.....	371
Instability. With Louis H. Bean and		red, potash content.....	399
Gardiner C. Means.....	171-197	red, soil requirements.....	764
The Remedies: Direct Aids to Farmers.		use for soil improvement, extension work.....	201
With O. V. Wells and D. S. Myer.....	279-288	Clyde soil area, description.....	1053, 1054
Cayucos soil area, description.....	1052, 1053	Coal ashes, beneficial effect on soils.....	516
Cecil soil area, description.....	1059, 1060	Cobalt, effects on animal and plant develop-	
Cedar, indicator of soil series.....	853	ment.....	818
Central Experimental Farms, Canada, experi-		Cocoa-shell meal, value as fertilizer material.....	516
ments with green manures.....	439	Cold zone, soils, classification.....	993
Cereal—			
crops, soil requirements.....	756-761		
scab, control by rotations.....	415		
straws, use for litter.....	451		

	Page		Page
COLE, JOHN S.—		Corn Belt—Continued.	
Special Dry-Farming Problems. With O. R. Mathews.	679-692	rotation practices.	420-422
Tillage. With O. R. Mathews.	321-328	soils, nitrogen content.	366
Colleges, State agricultural, extension work.	199, 200	Corncob ashes, composition and use as fertilizer.	519
Collington soil area, description.	1048, 1049	Corporations, comparison with individual farmers.	194-195
Colloids, soil—		Cossayuna soil area, description.	1035-1036
classification.	926	Cotton—	
definition, functions, and composition.	919-921	area, erosion-control methods.	668-671
description, behavior, importance, and changes.	912, 913	crop—	
determination of soil properties.	927, 928	fertilizer grades used and application.	539
electrodialysis.	921, 923	tillage machinery and operation.	342-344
function.	891	effect of potassium fertilizers.	402
ionization.	921	farming, effect on soil.	143-145
Coloma soil area, description.	1046, 1047	fertilizer application, recommendations.	559-560
Color terms, used in soil classification.	992	harvested, nitrogen content.	371
Colorado Agricultural Experiment Station, experiments with phosphorus.	473	hull ashes, composition and fertilizer value.	519
Colorimeter, test for soil acidity.	575, 576	potash content.	399
Colton soil area, description.	1023, 1024	prices, instability.	182
Composts—		rotation practices.	423-424
fertilizer value.	516	soil—	
value, preparation, and use.	463-466	and water losses under strip cropping.	638-639
Congress, spending power, definition by Supreme Court.	306-308	requirements.	761-762
Conifers—		yields—	
indicators of soil series.	840, 854	after turning under of legumes.	436, 437, 439
<i>See also</i> Pine; <i>also</i> under specific kinds.		after turning under of nonlegumes.	438-439
Connecticut Agricultural Experiment Station, soil tests.	472	experiments at Soil and Water Conservation experiment stations.	103
Conservation—		Cotton Belt—	
early measures.	114, 115	rotation practices.	423-424
long-term policy, needs.	3-19	soils, nitrogen content.	366
movement, before 1933 and afterwards.	279-283	Cottonseed meal, value and use as fertilizer material.	509
policy for subhumid and humid regions.	666-671	County agents—	
soil. <i>See</i> Soil conservation.		part in soil conservation work.	11-12
Constitution, State and Federal, changes, present trends and needs.	313-318	use of soil maps.	1010
Contour—		Cover crops—	
furrows—		effect in control of soil erosion.	443-444
conditions for use.	627, 628	principal.	440-443
use in pastures for moisture distribution.	656, 657	turning under for green manure.	440
<i>See also</i> Furrows.		use. A. J. Pieters and Roland McKee.	431-444
lines, relation to strip-cropping system.	643	Cowpeas—	
listing—		fertilizer application, recommendations.	562
effect on buffalo-grass yield and moisture penetration.	627	harvested, nitrogen content.	371
<i>See also</i> Listing.		Coxville soil area, description.	1110-1112
strips, use in erosion control on farms.	624	Cranberries, soil requirements.	770
Contours, plowing for erosion control.	30, 31	Credit—	
Conway soil area, description.	1065, 1067	easy, dangers.	272-273
COOPER, E. P.: Soil Potassium in Relation to Soil Fertility. With Oswald Schreiner and B. E. Brown.	397-405	emergency, description and disadvantages.	127-128
COOPER, M. R.: The Causes: Defects in Farming Systems and Farm Tenancy. With W. J. Roth, J. G. Maddox, R. Schickele, and H. A. Turner.	137-157	farm—	
Copper, effects on animal and plant development.	818-819	causes of soil abuse.	160-161, 162
Coral rock, of Hawaiian Islands, description.	1159	expansion through farm mortgages.	274-278
Corn—		extension and use, suggested reforms.	273-274
effect on nitrate content of soil.	349-350, 352	needs.	16
fertilizer grades used and application.	539	place in soil conservation program.	271-274
tillage machinery and operations.	344-346	supply, inadequacy.	181
diploida disease, control by rotations.	415	Creosotebush, indicator of soil series.	851
fertilization application, recommendation.	558-559	Crete soil area, description.	1102
growing, moisture-conservation practices in dry farming region.	686	Crop—	
harvested, nitrogen content.	371	adjustment, provisions under Agricultural Adjustment Act.	290-292
potash content.	399	combinations, value in erosion control.	637-639
rotation—		conflicts, effect on diversification.	407
plan.	409, 413	cuttings, successive, grown on same soil.	
practices.	420-422	chemical composition, analyses.	787-788
soil requirements.	757-758	diversification—	
yields—		effect of crop conflicts.	407
after turning under of legumes.	437-438, 439	value.	407
after turning under of nonlegumes.	438, 439	growth, fundamental relationships, discussion.	35-38
effect of hill and broadcast methods of fertilizing.	548	insurance, provision in Agricultural Adjustment Act.	290-291, 293
Corn Belt—		plants—	
erosion-control methods.	668-671	essential soil requirements for.	753-755
meat production with intensive cropping.	141-142	important, soil requirements.	756-776
		potassium requirements.	403-404
		production—	
		continuous, cause of phosphorus depletion.	381-384
		relation to lime consumption.	565-569
		productivity indexes, making.	1013
		reductions, relation to soil deficiencies.	20-22
		rotation. <i>See</i> Rotation, crop.	
		sequences, effect on yields.	430

Crop—Continued.	Page	Dams—Continued.	Page
varieties—		value for rearrangement of water supply.....	628
and soil, comparative influences on yield		Dark Brown soils, phosphorus content.....	381
and chemical composition.....	786-787	Dayton soil area, description.....	1050-1051
mineral composition, differences and		Debt farm-mortgage expansion, 1910-20.....	159
causes.....	784-786	Decatur soil area, description.....	1063-1064
yield—		Degraded Chernozem soils—	
effect of erosion on.....	99-103	characteristics, environment, and use.....	997
effect of soil losses.....	96-103	classification.....	993
experiments conducted by Soil Conserva-		formation.....	971
tion Service.....	101-103	See also Chernozem soils.	
increases, maintenance through improved		Dekalb soil area, description.....	1022, 1023
cultural practices.....	97-99	Delmar soils, development.....	968
relation to land values.....	352	Demonstration—	
relation to water supply in dry farming..	684	project, soil-erosion, typical.....	206-209
Cropland—		work, establishment and functioning.....	199-211
abandoned, natural revegetation.....	625-626	Demonstrations, soil conservation. See Soil	
acreage, extent and distribution.....	592-593	conservation demonstrations.	
Cropping—		Denmark, land settlement, legislation.....	132
cause of soil losses.....	87	Denton soil area, description.....	1107, 1108
continuous, effect on mineral composition of		Depression, cure by spending program.....	189-191
crops.....	783-784	Depressions, need of artificial stimuli.....	189
contour strip, description.....	634-635	Deschutes soil area, description.....	1125
field strip, description.....	635-636	Desert—	
intensive, with meat production in Corn		pavement, definition, description, and	
Belt.....	141-142	value.....	963
strip—		salt shrub, indicator of soil series.....	852
Walter V. Kell.....	634-645	savanna, indicators of soil series.....	848, 849
advantages.....	639-641	shrub—	
combining with crop rotation.....	644-645	northern, indicator of soil series.....	850-851
cotton, soil and water losses.....	638-639	southern, indicator of soil series.....	851
explanation.....	634-636	soils—	
system, laying out.....	641-644	characteristics and formation.....	964, 971, 972
use in erosion control.....	30-31	characteristics, environment, and use.....	996
value in erosion control.....	664	classification.....	993
vegetative form of erosion control.....	636-639	description.....	1098-1100
systems—		phosphorus content.....	381
on farms of various types.....	140	Deserts, organic matter and humus under.....	936, 937
See also Rotation; Rotations.		Dewberries, soil requirements.....	769
wind strip, description.....	636	Dewey soil area, description.....	1063, 1064
Crops—		Diablo soil area, description.....	1106, 1107
chemical composition, effect of balanced		Dickson soil area, description.....	1062
fertilizer treatment, experiments.....	795-797	Diet, relation to soil deficiencies.....	864-866
classes for rotation planning.....	408, 410-411	Ditches, in interception, use and location.....	648
dry-land, efficiency of water use.....	689-690	Diversion channels, construction and use.....	648, 649
"duty of water," definition and calcula-		Dolomite, use in fertilizer mixtures.....	505
tion.....	699-700	Douglas fir, indicators of soil series.....	853, 854
green-manure. See Green-manure crops.		Drainage—	
harvested, nitrogen content per crop acre.....	371	facilities, needs in irrigated arid regions.....	717-719
injuries from mixed fertilizers, prevention.....	535-536	farm land, necessity.....	723-727
interrillage, objectives.....	327-328	in arid regions. James Thorp and C. S.	
mineral—		Scofield.....	717-722
composition, factors affecting.....	782-797	in humid region. John R. Haswell.....	723-736
content, increase by means of fertilizer		of areas and wildlife habitats, problem. F.	
treatments.....	797-799	R. Kenney and W. L. McAtee.....	77-83
miscellaneous, ash content, analyses.....	781-782	of swamp lands, effects.....	78-82
row-spaced, on various soil types and land		practices in humid regions.....	34, 35
slopes, soil and water losses.....	620	practices, progress in arid regions.....	718-721
soil-improving, southern, used by experi-		projects, difficulties, causes.....	77-83
ment stations, list.....	442	requirements of various soil types.....	724-726
spacing for moisture conservation.....	686	systems, designs.....	734, 735
water-conserving, use in dry farming.....	685-686	systems, requirements.....	721-722
water losses, sources and prevention.....	688-689	types, description.....	727-729
See also under specific kinds.		Drains—	
Crosby soil area, description.....	1040-1041	intercepting, location.....	720
Crotalaria, value as cover crop.....	440, 443	mole, construction and installation.....	729-732, 733-734
Crowley soil area, description.....	1115	tile, construction and installation.....	729-733, 735-736
Cruciferae, soil requirements.....	774	types and construction.....	727-736
Crustacean materials, fertilizer value.....	517	Drought—	
Cucurbits, soil requirements.....	774-775	conditions, effect on types of plant growth.....	855
Cultivation, objectives.....	339-342	cycle in Great Plains region.....	69-70
Cultivators, kinds and uses.....	339-342	effects in Great Plains region.....	72
Cultural systems, development, relation to		occurrence on range lands, results.....	75
soil groups.....	875-878	Dry farming—	
Culvers soil area, description.....	1025	land use problems.....	679-680
Cunninghamella, use to determine fertilizer		nitrate problem, peculiarities.....	680-682
needs of soil.....	944	problems.....	32-35
Cypress, indicator of soil series.....	842	relation of crop yields and water supply.....	684
		special problems. O. R. Mathews and John	
		S. Cole.....	679-692
Dairy—		Dry-land—	
farming, aid to soil maintenance.....	139-140	area, soil qualities.....	680
region, rotation practices.....	424-425	regions, farming problems.....	68-72
Damping off, in sugar beets, control by rota-		rotations, practices.....	427-428
tions.....	416	soils, qualities.....	680
Dams—		Dukes soil area, description.....	1025-1026
types and uses in channels.....	661-662		

	Page		Page
Dune, sand areas, description.....	1136-1137	Erosion—Continued.	
Dunellen sandy loam, potash content.....	398	soil—Continued.	
Dunes, cause and prevention in erosion control.....	664-665	control remedies.....	90-92
Dungstead, Württemberg, structure and use for storing manure.....	453-454	control studies.....	28-32
Dust storm, Feb. 6, 1937, analysis of soil derived from.....	591	economic and social effects.....	599-600
Dust storms, prevalence in Great Plains region.....	71	effects.....	103-110, 595-599
Dutchess soil area, description.....	1035-1036	place in history of civilization, résumé.....	581-583
Duval soil area, description.....	1085-1086	problem, general aspects. Hugh H. Bennett and W. C. Lowdermilk.....	581-608
Earth's crust, chemical composition.....	918	problem in United States.....	590-593
Earthworms, aid to soil development.....	946, 965	program, cooperation of Government agencies and services, projects and problems.....	283-287
Ecology, of plants and soils, relationships.....	835-840	rates.....	593-595
Economic—		survey in watershed area of Texas.....	603-606
instability—		water—	
cause of soil misuse. Louis H. Bean, J. P. Cavin, and Gardiner C. Means.....	171-197	control recommendations.....	28-32
effect on agriculture.....	187-189	description and effects.....	583-589
stability, recommendations for.....	190-191	prevention in semiarid regions.....	682-683
Ector soil area, description.....	1127	wind—	
Education—		control in southern Great Plains.....	204
necessity in land utilization program.....	11-19	control recommendations.....	28-32
remedy for soil misuse. C. W. Warburton, C. B. Manifold, Charles E. Kellogg, and C. P. Barnes.....	198-222	description and effects.....	589-590
Electric power, possibilities for agriculture.....	869	measures for combating.....	662-665
Electricity, possibilities for agriculture.....	869	prevention by tillage.....	327
Electrodialysis of soils or soil colloids, outline.....	921-923	prevention in semiarid regions.....	682-683
England—		Estates, large, inheritance.....	116-117, 118
land policy and property rights.....	130, 131	Europe—	
land-tenure system, effects.....	116-117, 130	forest land management and property rights.....	133-136
ENLOW, C. R.: Grass and Other Thick-Growing Vegetation in Erosion Control. With G. W. Musgrave.....	615-633	land tenure, laws.....	129-133
Erosion—		property rights in forest land management.....	133-136
cause of phosphorus depletion.....	381-384	Everett soil area, description.....	1036
cause of soil losses.....	88-89	Ewing, P. A.: Irrigation in the United States. With Wells A. Hutchins and M. R. Lewis.....	693-703
classes, description.....	91-92	Extension—	
control—		agents, work.....	198-205
aid by mechanical devices.....	626-628	programs, arrangement.....	199
by grass and other thick-growing vegetation. E. R. Enlow and G. W. Musgrave.....	615-633	work in—	
by increased water absorption, mechanical methods.....	653-654	agronomy.....	199-200, 201
by mechanical measures. M. L. Nichols and T. B. Chambers.....	646-665	soil improvement.....	200-203
by reforestation, status and prospects.....	613-614	Extension Service—	
by strip cropping.....	634-645	educational work for farmers.....	11-12
coordinated programs, illustrations.....	671-678	financing.....	199
cultivated fields, mechanical methods.....	648	soil-conservation educational program.....	283
developments on farms.....	624-630	Fairmount soil area, description.....	1036-1037
devices, adaptation to rotations.....	420	Fallow, management for moisture conservation in dry farming region.....	686-688
effect of rotations.....	419-420	Fannin soil area, description.....	1123
measures for gullies.....	662	Fargo soil area, description.....	1077
measures for water channels.....	658-662	Farm—	
measures on range lands.....	658	credit. See Credit, farm.	
on pastures, mechanical methods.....	656-658	dependence on services of city.....	872-873
plants recommended for.....	629-633	financing—	
value of forests. E. N. Munns, John F. Preston, and Ivan H. Sims.....	609-614	effect on tenancy.....	162-163
wind and water problems in dry farming work, provisions for under Standard State Soil Conservation Districts Law.....	248-253	recommendations.....	274-278
effect of tillage.....	326-327	land—	
effects on crop yields.....	99-103	distribution by crop or other use.....	146
gully, description and effects.....	585-588	eroded, acreage abandoned.....	29-30
measurements, of Shelby loam.....	419	leases. See Leases.	
physical processes.....	609-611	mortgages. See Mortgages, farm.	
problems on Great Plains.....	667-668	ownership—	
reconnaissance survey.....	5-7, 90-92	absentee, effect upon land-use practices.....	151, 156-157
relation to phosphorus requirements.....	395-396	benefits from mortgage financing.....	274-278
rill, description and effects.....	584-585	programs, coordinated, for erosion control.....	671-678
sheet, description and effects.....	583-584	reorganization, recommendations.....	236-237
soil—		settlement, on unfit land, causes and results.....	60-63
acreage affected and degree, by geographic regions.....	90	tenancy. See Tenancy, farm.	
control by use of cover crops, effectiveness.....	443-444	See also Farms.	
control, coordinated approach. Ervin J. Utz.....	666-678	Farm Credit Administration—	
control recommendations.....	600-606	aid to farmer.....	72
		funds, availability to farm families.....	55
		Farm Security Administration—	
		aid to farm families.....	55
		purchases of public domain lands.....	247-248
		Farmer—	
		and the Soil.....	319-750
		use of soil map.....	1003
		Farmers—	
		aid by Government agencies and services.....	283-286
		direct aid by remedying soil misuse. O. V. Wells, J. P. Cavin, and D. S. Myer.....	279-288
		relation to soil—	
		factors affecting.....	869
		management program.....	19-35



Farmers—Continued.	Page	Fertilizers—	Page
State aids and subventions, disadvantages.	128-129	application—	
tenant, number and proportion in United States.	148-149	in rotations.	411
Farming—		methods. Robert M. Salter.	546-562
dry. <i>See</i> Dry farming.		recommended methods for important crops.	558-562
hill regions, East and South, problems.	63-67	availability—	
subsistence, description and location.	63	and utilization of phosphorus.	390-395
systems—		means of increasing.	393-395
defects, cause of land misuse.	8-9	balanced treatments, effect upon chemical composition of grapevine leaves.	795
defects, cause of soil misuse. M. R. Cooper, W. J. Roth, J. G. Maddox, R. Schickele, and H. A. Turner.	137-157	commercial—	
improper, causes of soil misuse.	137-138	essential elements.	492-498
types, changes in United States.	71	grades.	539
unfit land in humid areas, problem. C. P. Barnes.	60-67	high- and low-analysis.	528-532
Farms—		value, comparison with manure.	446
cash rental, disadvantages.	156	distribution by machinery, methods.	555-558
characteristics by types.	147	drillability, factors determining.	532-533
community test-demonstration, organization and work.	201-203	effect on chemical composition of crops.	794-799
erosion control practices.	624-630	efficiency—	
family-sized, advantages over large estate.	116-117	and reactions.	26-27
leasing practices.	155, 157	factors affecting.	532-537
mapping in Tennessee Valley.	1010-1011	for grasslands, requirement.	628-629
number operated by tenants, stated years.	149-150	granulation, methods and results.	534-535
owner- and tenant-operated, land utilization, comparison, 1935.	154	influence in soil reaction, factors affecting variations.	537
rental agreements, factor in maintenance and improvement.	151, 153-155	injury to crops, prevention.	535-536
size, relation to—		localized placement, effects.	547-550
gross income.	147	mixed—	
soil misuse.	146-148	William H. Ross and Arnon L. Mehring.	522-545
typical, cropping systems.	140	advantages.	522-523
<i>See also</i> Farm.		balanced formulas.	538-539
Fauna, soil. Charles Thom and Nathan R. Smith.	940-947	effects on soil reaction.	536-537
Federal Emergency Relief Administration, grants for relief.	126-127	manufacturing methods.	525-526
Federal Government. <i>See</i> Government.		properties.	532-537
Feedstuffs, constituents, utilization in digestive process.	449	phosphatic, work of Tennessee Valley Authority.	202-203
Fertility, soil—		plant in soil, methods.	550-555
and phosphorus deficiency. W. H. Pierre.	377-396	plant-food content, changes.	523-524
effect of crop rotation.	409-412	potash, sources.	400-401
experiments, long-term, results.	483-486	prices, factors affecting.	540-543
maintenance.		segregation, factors determining.	533
role of nitrogen.	361, 370	split applications, determinations.	553-555
role of phosphorus.	377-380	tests, greenhouse methods.	480-482
recommendations for South.	145	use for increasing mineral content of crops.	797-799
relation to soil potassium. H. P. Cooper, Oswald Schreiner, and B. E. Brown.	397-405	value to soil fertility.	24-28
restorative steps.	360	FAUSTEL, IRWIN C.: The Nature and Use of Organic Amendments.	462-468
Fertilizer—		Fields—	
application, cause of phosphorus accumulation.	392-393	cultivated, erosion control by mechanical methods.	648
control, legislation.	544-545	strip-cropping system, laying out.	641-644
demonstrations and quick soil tests, extension work.	201	Finance, agricultural. <i>See</i> Agricultural finance.	
distributors, improvement trends.	557-558	Fir, indicator of soil series.	840, 853
formulas, single and double strength, mixtures.	530-532	Fish scrap—	
materials—		preparation and value as fertilizer material.	509
Oswald Schreiner, Albert R. Merz, and B. E. Brown.	487-521	use in mixed fertilizers.	536-537
available for use, 1900, 1936.	490	Flax, soil requirements.	762
evaluation dependent upon effect on crop growth.	506	Flood Control Act, relation to erosion control.	252-253
important, description and uses.	506-519	Floods, effect of soil erosion on.	103-110
influence of World War.	488-492	Flora, soil. Charles Thom and Nathan R. Smith.	940-947
principal commercial, nitrogen content.	497	Florence soil area, description.	1055
potash content.	503	Florida, land-use adjustment projects.	236
residual effect upon soil reaction.	519-521	Fluorine, effects on animal and plant development.	820
secondary elements.	504-506	Food plants, mineral elements in.	778
sources and costs.	540-543	Forage—	
<i>See also</i> under specific name.		crops, aid to soil maintenance.	139
mixtures—		production, vegetation types adapted to.	856
ammoniation process.	526-528	Forest—	
single and double strength, formulas.	530-532	areas, location, limiting factors.	611-613
patterns, types and uses.	550-553	cover—	
requirements of soils, determination. Oswald Schreiner and M. S. Anderson.	469-486	contribution to soil characteristics.	738-740
treatment, experimental methods.	24-25	restoration for watershed protection.	614
		value in erosion control.	610-611
		cutting, effect on soil.	740-741
		fires—	
		control, effect on rehabilitation of forest soil.	748
		effect on soil.	741-744
		land—	
		management and property rights in Europe.	133-136
		use, changes, control in Europe.	135

Forest—Continued.	Page	Government—Continued.	Page
lands, soil use and vegetation management, technique.....	226-227, 229-230	objectives in national soil conservation program.....	606-608
properties, taxation, results.....	165, 167-168, 170	Grain production—	
protection, necessity for.....	613	exclusive, effect on yields.....	142-143
regions, cut-over, soil problems.....	60-63	in South, opportunities.....	144
soils—		Grains—	
cultivation, effect on fertility.....	745-746	effect of potassium fertilizers.....	402
management. Ivan H. Sims, E. N. Munns, and John T. Auten.....	737-750	small—	
management problems.....	35, 740-746	fertilizer application, recommendations.....	561
rehabilitation methods.....	746-750	production, vegetation types adapted to.....	856
See also Forests.		Gramae—	
Forest Service, land-use planning.....	231	blue, indicators of soil series.....	845-846, 847-848
Forestry, sustained-yield, policies in Europe.....	134, 135, 136	grasses, indicators of soil series.....	846-847, 848
Forests—		Granville soil area, description.....	1074
corporation ownership in Europe.....	135	Grapes, soil requirements.....	770
for erosion control. E. N. Munns, John F. Preston, and Ivan H. Sims.....	609-614	Grapevine leaves, chemical composition, effect of balanced fertilizer treatment.....	795
Government control in Europe.....	135-136	Grass—	
organic matter and humus under.....	935-936	cover, maintenance of organic matter.....	621-622
protection from fire and grazing.....	742	plots, herbage, chemical composition, experiments at Rothamsted, 1856-73.....	794
river-bottom, indicators of soil series.....	842	retardation of surface run-off.....	622-623
western, indicators of soil series.....	853	use in erosion control on farms.....	624-626
See also Forest.		value in erosion control. C. R. Enlow and G. W. Musgrave.....	615-633
Formamide, value as nitrogen carrier.....	481	Grasses—	
Fort Collins area, description.....	1092	chemical content, seasonal deficiencies.....	804, 805-806
France, land—		indicators of soil series.....	843-849
inheritance, results of system.....	117	native, displacement by undesirable species, causes.....	615-617
policy and property rights.....	120-130	on various soil types and land slopes, soil and water losses.....	620
Frederick soil area, description.....	1037-1038	promising for soil conservation.....	630-633
Fresno soil areas, description.....	1118-1119	short, indicators of soil series.....	845-848
Fruits—		soil requirements.....	762-763
small, soil requirements.....	769-771	tall, indicators of soil series.....	843-844
See also under specific kinds.		use in—	
Fungi—		erosion control.....	30
in soil, distribution, functions, and damage.....	945	maintaining soil fertility.....	22-23
residues in soil, chemical composition.....	965	See also under specific kind.	
role in soil development.....	965	Grasslands—	
Furrows—		fertilizer requirement.....	628-629
sizes and uses.....	657	moisture conservation by mechanical devices.....	625
See also Contour furrows.		organic residues and humus under.....	934-935
Garbage—		Plains, indicators of soil series.....	845-848
preparation and use as fertilizer.....	466	prairie, indicator of soil series.....	843-844
tankage, preparation and value as fertilizer mixture.....	509-510	soils, classification.....	993
Georgeville soil area, description.....	1064-1065	GRAY, L. C.: The Causes: Traditional Attitudes and Institutions. With John B. Bennett, Erich Kraemer, and W. N. Sparhawk.....	111-136
German Hereditary Holdings Act of 1933, restrictions.....	133	GRAY, R. B.: Tillage Machinery.....	329-346
Germanium, occurrence in marine plants.....	820	Gray-Brown Podzolic soils—	
Germany—		characteristics, environment, and use.....	998
forest legislation.....	134, 135	classification.....	994
Homestead Act of 1920, restrictions.....	132, 133	description, regions, and formation.....	973, 1033-1052
land ownership, regulations.....	130, 131, 132, 133	phosphorus content.....	351
Chipin soil area, description.....	1048	Grazing—	
GLICK, PHILIP M.—		associations—	
The Remedies: Policies for Private Lands. With George S. Wehrwein, Clarence I. Hendrickson, M. H. Saunders, Carl C. Taylor, Francis R. Kenney, and Marshall Harris.....	241-264	cooperative, organization.....	245-248
The Soil and the Law.....	296-318	development.....	145
GLINKA, K. D., work in soil science.....	881	effect on forest soil.....	744-745
Glossary, terms used.....	1162-1180	land types, list.....	856
Gloucester—		lands, vegetation types adapted to.....	857
soil area, description.....	1030-1031	limitation, effect on rehabilitation of forest soil.....	748
soils, derivation and characteristics.....	960	management in livestock production.....	617-619
Gneiss, description, formation, and weathering.....	952	on public domain, effects.....	114
Gold, distribution in nature.....	820	regulation for erosion control on ranges.....	658
Goliad soil area, description.....	1100-1110	uncontrolled, effects in Great Plains region.....	74-76
GOURLEY, J. H.: The Soil Requirements of Economic Plants. With M. F. Morgan and J. K. Ableiter.....	753-776	Greasewoods, indicators of soil series.....	852
Government—		Great Britain, land-tenure system, results.....	116-130
activities for general economic stabilization, discussion.....	293-295	Great Plains—	
expansion of public works for depression cure.....	189-191	dry-land rotation practices.....	427-428
Federal, legislative powers and limitations.....	297-299	erosion-control methods.....	666-668
legislative—		grasslands, indicators of soil series.....	845-848
functions, relation to land utilization programs.....	296-318	land-use adjustment projects.....	237
trends and needs.....	313-318	region, dry-land farming problems.....	68-72
		southern, wind erosion, control work.....	204
		States, drought-relief aid.....	71, 72
		GREEN, ROY M.: The Remedies: Changes in Agricultural Finance. With Donald Jackson, R. Clifford Hall, and David L. Wickens.....	265-278



	Page		Page
Iowa Agricultural Experiment Station— formula for compost.....	464	Lahontam soil area, description.....	1119-1120
soil-fertility experiments, long-term.....	485	Lake Charles soil area, description.....	1115
Iron—		Lake States, land-use adjustment projects.....	236
effects on animal and plant development.....	821	Lakewood—	
phosphate, availability to plants.....	387, 388, 389	sand, potash content.....	398
Iron River soil area, description.....	1024-1025	soil area, description.....	1025-1026
Irrigation—		Land—	
agriculture, relation of soil, water supply, and soil solution. C. S. Scofield.....	704-717	classification—	
failure, consequences.....	72-73	according to slope.....	986
farming problems.....	32-35	and irrigation.....	697
flood, use in erosion control on ranges.....	658	cultivation, North and South, different tendencies.....	64-65
history, progress, and results.....	693-695	damage by soil, erosion, extent.....	592-593
in United States. Wells A. Hutchins, M. R. Lewis, and P. A. Ewing.....	693-703	farm, division through inheritance, results.....	116-117
laws and customs relating to.....	698	Federal purchase, program, major prin- ciples.....	237-240
limiting factors and major aspects.....	704-705	forested, proposed acquisition for watershed protection.....	614
need for drainage facilities.....	717-719	grants, conditional, by Government.....	279-283
part in soil conservation program.....	15-16	inheritance, system in United States.....	115-119
projects—		misuse, result of public aids to individuals and communities.....	125-129
rotation practices.....	428-429	policy—	
soil misuse on, consequences.....	72-73	lack of, cause of soil misuse.....	7-8
relation to land classification.....	697	traditional, in America, description and results.....	111-115
research and problems.....	702-703, 715-716	prices, high, danger to soil fertility and ownership.....	162
soil characteristics necessary for supplemental, types.....	695-697	public—	
water.....	710-715	distribution policy.....	112-113
alkali content.....	713-715	early attitudes toward.....	112-113
quality.....	713-715	purchase.....	234-240
Irvington soil area, description.....	1073	reforms, European, benefits and disadvan- tages.....	129-131
JACKSON, DONALD—		resources, depletion in poor farming areas.....	145-146
The Causes: Imperfections in Agricultural Finance. With David L. Wickens and R. Clifford Hall.....	158-170	rough—	
The Remedies: Changes in Agricultural Fi- nance. With R. Clifford Hall, Roy M. Green, and David L. Wickens.....	265-278	broken areas, description.....	1128
Joplin soil area, description.....	1090	broken, of Hawaiian Islands, description.....	1159-1160
Junegrasses, indicators of soil series.....	844, 845-846, 848	of Hawaiian Islands, description.....	1159-1160
Juniper, indicator of soil series.....	854	stony areas, not forested, description.....	1127-1128
Kainite, description and fertilizer value.....	515	stony, undifferentiated, soil area, descrip- tion.....	1124-1125
Katy soil area, description.....	1112	settlement—	
Keith soil area, description.....	1081-1082	laws, restriction upon ownership in Europe.....	131-132
KELL, WALTER V.: Strip Cropping.....	634-645	relation to values and speculation.....	119-125
KELLOGG, CHARLES E.		slope and area, effect on erosion.....	637-639
Formation of Soil. With H. G. Byers, M. S. Anderson, and James Thorp.....	948-978	slopes, soil and water losses when planted to grass and row crops.....	620
Soil and Society.....	863-886	speculation—	
Soil Classification. With Mark Baldwin and James Thorp.....	979-1001	control, recommendations.....	125
The Problem: The Nation As a Whole. With E. J. Utz, E. H. Reed, J. H. Stallings, and E. N. Munn.....	84-110	effects.....	112-113, 119-125
The Remedies: Education and Research. With C. W. Warburton, C. B. Manifold, and C. P. Barnes.....	198-222	submarginal, proposed acquisition for water- shed protection.....	614
KENNEY, F. R.		suitable for cultivation, tests.....	92-96
The Problem: Drained Areas and Wildlife Habitats. With W. L. McAtee.....	77-83	surface, protection by vegetation intercept- ing rainfall.....	620-621
The Problem: Submarginal Areas. With John B. Bennett and W. R. Chapline.....	68-76	surface run-off, velocities, effects.....	622-623
The Remedies: Policies for Private Lands. With George S. Wehrwein, Clarence I. Hendrickson, M. H. Sanderson, Philip M. Glick, Carl C. Taylor, and Marshall Harris.....	241-264	susceptibility to various types of erosion.....	583-590
Kentucky bluegrass, soil requirements.....	762	tax-delinquent, ownership and administra- tion.....	232-234
Kettleman soil area, description.....	1108	tenure—	
Kewaunee soil area, description.....	1042	collectivist movement in Europe.....	131
KING, FRANKLIN H., work in soil science.....	883	European views.....	129-136
Kinkaid Act, provisions.....	113	laissez-faire policy.....	112
Kittson soil area, description.....	1112-1113	unfit for farming in humid areas, problem. C. P. Barnes.....	60-67
KNAPP, SEAMAN A., establishment of demon- stration work.....	199	use—	
Konokti soil area, description.....	1058	adjustment projects of Agricultural Ad- justment Administration.....	235-237
KRAEMER, ERICH: The Causes: Traditional Attitudes and Institutions. With L. C. Gray, John B. Bennett, and W. N. Spar- hawk.....	111-136	classification.....	218-219
Labor, cropper, disadvantages.....	156	determination by use of soil map.....	1010
Lackawanna soil area, description.....	1025	maladjustments, correction by public pur- chase.....	234-240
		planning, phases, techniques, and status.....	217-222
		planning, ways, and means.....	222
		plans, formulation, coordination.....	221-222
		programs, relation to legislative functions of Government.....	296-318
		regulation in foreign countries.....	8
		regulations, due process and police power.....	300-302
		result of weight of property taxes.....	163-166
		undesirable results in Great Plains.....	71-72

Land—Continued.	Page		Page
utilization—		Leunasalpeter, description and value as fertilizer material.....	510
for stabilization of price levels, methods.....	289-292	LEWIS, M. R.: Irrigation in the United States.	
on full-owner and tenant-operated farms,		With Wells A. Hutchins and P. A.	
comparison, 1935.....	154	Ewing.....	693-703
program, Federal, benefits.....	256-259	Lime—	
program, needs for national policy.....	606-608	budget, balancing.....	565-569
relation to property-tax reform.....	271	consumption, factors affecting.....	565-569
values—		importance in soil fertility.....	27-28
changes, causes and results.....	119, 120-123	kin ashes, fertilizer value.....	519
relation to crop yields.....	352	losses in soil, comparison with returns in	
Land Use Coordination, Office of—		manure and crop residues.....	565-569
functions.....	13	use in—	
objectives.....	1-2	pasture improvement.....	628
Land-Use Planning, Coordinator of, appointment and work.....	220	soil, methods of application.....	563-580
Landlords, contracts with tenants, changes recommended.....	259-264	uses and amount of applications.....	569-570
Lands—		value as soil amendment, and sources.....	517
private, policies and remedies. George S.		Limestones, dolomitic, use in fertilizer mix-	
Wehrwein, Clarence I. Hendrickson, M.		tures.....	505
H. Sanderson, Philip M. Glick, Carl C.		Liming, influence on phosphorus availabil-	
Taylor, Francis R. Kenney, and Marshall		ity.....	388-390
Harris.....	241-264	Lindley soil area, description.....	1034
public, policies for, remedies for soil misuse.		Linne soil area, description.....	1108
Earle H. Clapp, E. N. Munns, I. H. Sims,		Linseed meal, preparation and value as fer-	
George S. Wehrwein, and C. F. Clayton.....	223-240	tizer material.....	510
rural, zoning policies.....	241-245	Listing—	
State-owned, management.....	231-234	basin, method and use.....	654, 663-664
State sales.....	231-232	value in combating wind erosion.....	663-664
Landscape, relation to soil.....	864-867	See also Contour listing.	
Landslides, agent in weathering rocks.....	956	Literature cited.....	1181-1207
Landsale soil area, description.....	1047-1048	Lithium, effects on plant development.....	822
Laterite soils—		Lithosol soils—	
characteristics.....	961, 973-974	characteristics, environment, and use.....	1001
characteristics, environment, and use.....	998	classification.....	995
classification.....	994	description.....	1120-1128
formation and characteristics.....	973-974	in Puerto Rico and Virgin Islands, descrip-	
in Puerto Rico, description.....	1142	tion.....	1145-1146
Lateritic soils, of Hawaiian Islands, descrip-		of Hawaiian Islands, description.....	1157-1159
tion.....	1159	Litter—	
Lava—		materials, characteristics.....	451
bed soil areas, description.....	1128	requirements as constituent of manure.....	450-452
beds, on Hawaiian Islands, description.....	1160-1161	Livestock—	
Law and the soil. Philip M. Glick.....	296-318	alkali disease, investigations.....	830
Lawes, John, founder of commercial fertilizer		overgrazing, effects on range lands.....	73-76
industry.....	523	production, pasture management.....	617-619
Laws—		See also Animals.	
inheritance, trend and effects.....	116-119	Living—	
land-disposal, early.....	123-124	matter, concentration in soil.....	929-930
Leaching—		standards, change, effects upon use of soils.....	870-871
cause of—		Loans—	
soil losses.....	87-88	commodity, provisions in Agricultural Ad-	
soil-nitrogen losses.....	371	justment Act.....	290
Lead, occurrence in plants and animals.....	821-822	emergency, in Great Plains region, 1933-38.....	72
Leafmold, value as compost.....	465-466, 467, 468	farm, emergency, benefits and disadvantages.....	127-128
Leases—		farm. See also Mortgages, farm.	
agricultural, recommendations.....	260-261, 264	mortgage, short-term, effects.....	161
crop-share, advantages and disadvantages.....	155	on farm properties, reforms.....	273-274
farm, terms, influence on soil depletion.....	153-157	Lordstown soil area, description.....	1038-1040
Lebanon soil area, description.....	1058-1059, 1061-1062	Los Osos soil area, description.....	1052-1053
Leetonia soil area, description.....	1022-1023	Louisiana, winter legumes, benefits.....	200
Legumes—		Louisiana Agricultural Experiment Station,	
addition of nitrogen to soil, quantity, esti-		experiments with green manures.....	439
mation.....	434	LOWDERMILK, W. C.: General Aspects of the	
contribution to nitrogen content of soil.....	356	Soil-Erosion Problem. With Hugh H.	
function of nitrogen fixation and gathering.....	414	Bennett.....	581-608
importance in fixation of nitrogen.....	944	Lowell soil area, description.....	1036-1037
soil requirements.....	763-765	Machinery—	
turning under, effect on yield of subsequent		fertilizer-distributing, types and uses.....	555-558
crops.....	436-438	terracing, county ownership and opera-	
use in—		tion.....	203-204
erosion control.....	30	tillage. R. B. Gray.....	329-346
maintaining soil fertility.....	22-23	MADDOX, J. G.: The Causes: Defects in Farm-	
value—		ing Systems and Farm Tenancy. With	
as green-manure crops.....	433-434,	M. R. Cooper, W. J. Roth, R. Schickele,	
	436-437, 439	and H. A. Turner.....	137-157
in rotations.....	412-414	Madera soil area, description.....	1104-1105
winter, planting for soil improvement, ex-		Magnesium—	
tension campaign.....	200	deficiency in soils and sources in fertilizer	
Lehew soil area, description.....	1121-1122	mixtures.....	504-505
LEIGHTY, CLYDE E.: Crop Rotation.....	406-430	effects on plant development.....	822-823
Leon soil area, description.....	1113-1115	phosphate, availability to plants.....	387
Leunaphos, description and use.....	510	Magnolia soil area, description.....	1065
		Mahoning soil area, description.....	1051

	Page		Page
Manganese—		Miami—	
deficiency, tests with tomato plant.....	482	soil area, description.....	1040-1042
effects on animal and plant development.....	823-824	soils—	
MANIFOLD, C. B.: The Remedies: Education		groups.....	987
and Research. With C. W. Warburton,		characteristics.....	960
Charles E. Kellogg, and C. P. Barnes.....	198-222	development.....	960, 968, 973
Manor soil area, description.....	1034-1035	Michigan, tax-delinquent land policy.....	232-233
Manure—		Michigan Agricultural Experiment Station,	
artificial, preparation and value.....	516	soil tests.....	472
farm—		Micro-organisms—	
Robert M. Salter and C. J. Schollenberger		activity in soil.....	368-369, 933-934
losses, value, and benefits.....	445-461	function in soil.....	348, 356, 362, 364, 414
organic constituents, value.....	448	in aerial portion of plants, return to soil.....	941
production process.....	448-450	in soil, activity and distribution.....	940-941
use in maintaining soil fertility.....	23-24	relation to soil decomposition.....	42
handling, practical, recommendations.....	459-461	role in development of soil.....	965
losses—		Migration—	
of fertilizer materials.....	452-455	farm and nonfarm population, trends.....	48-54
prevention methods.....	456-459	of population, relation to resettlement pro-	
reduction by chemical agents.....	455-456	gram.....	253-256
requirements of litter as constituent.....	450-452	Milaca soil area, description.....	1024-1025
rotting process, desirability, and losses.....	452	Miles soil area, description.....	1086-1087
salts, description.....	515	Mineral—	
spreading, recommendations.....	457-458	composition of—	
straw, use, disadvantages.....	452	crops, factors affecting.....	782-797
value, comparison with commercial ferti-		igneous rocks, shales, and sandstones.....	918
lizers.....	446	soil.....	916-919
Manures, animal, use in maintaining soil fer-		content of rocks, soils, food plants, and	
tility.....	23-24	man.....	778
Maple, indicator of soil series.....	840-841	phosphates, availability to plants.....	387, 388
Maps, soil—		Minerals—	
making.....	1004-1007	ingredients of—	
reading.....	1008-1010	plant juices and tissues.....	780-782
requirements.....	988, 989	soil solutions.....	779-789
types.....	1007-1010	natural storage in soil.....	347-348
use. J. Kenneth Ableiter.....	1002-1015	rock, progressive hydrolysis.....	973-975
use in connection with productivity ratings.....	1013	soil—	
value to farmer.....	1003	interrelation with nitrogen and organic	
Marble, formation.....	953	matter.....	355-357
MARBUT, C. F., soil classification.....	982-984, 989-990	level of, influence of organic-matter supply.....	357
Marl, greensand, fertilizer, value.....	517	weathering, types.....	918
Marshall soil area, description.....	1056-1057	Minnesota, hay grown on phosphorus-defi-	
Marshland, coastal, areas, description.....	1132-1133	cient soils, composition.....	806
Maryland Agricultural Experiment Station,		Missouri, real estate, index of value per acre,	
soil tests.....	471	1820-1930.....	120
MATHEWS, O. R.—		Missouri Agricultural Experiment Station—	
Special Dry-Farming Problems. With John		erosion measurements.....	419
S. Cole.....	679-692	formula for compost.....	464
Tillage. With John S. Cole.....	321-328	Missouri Extension Service, work with clover.....	201
Maumee soil area, description.....	1115-1117	Mohave soil area, description.....	1100-1101
Mauzy soil area, description.....	1068	Moisture—	
Maverick soil area, description.....	1093-1094	conditions, effect on types of plant growth.....	855
McATEE, W. L.: The Problem: Drained Areas		in soil—	
and Wildlife Habitats. With F. R. Kenney.....	77-83	absorption, value of sod crops.....	358-359
McCammon soil area, description.....	1125	basic facts.....	33
McKEE, ROLAND: The Use of Cover and		constants.....	908-910
Green-Manure Crops. With A. J. Pieters.....	431-444	control by tillage and rotation practices.....	690-692
McMURTRY, J. E., Jr.: Neglected Soil Con-		effect on types of plant growth.....	855
stituents That Affect Plant and Animal		losses.....	906-907
Development. With W. O. Robinson.....	807-829	penetration, buffalo-grass sod, effect of	
Meadow soils—		contour listing.....	627
characteristics, environment, and use.....	999	problems in semiarid regions.....	683-690
classification.....	994	sources and utilization in dry farming.....	683-690
formation.....	975	storage, requirements.....	754
See also Wiesenboden soils.		storage, value of sod crops.....	358-359
Meadows, established, fertilizer application,		Molds in soil, important genera and damage.....	945
recommendations.....	561	Molybdenum, effects on animal and plant	
MEANS, GARDINER C.: The Causes: Price		development.....	824
Relations and Economic Instability. With		Monetary policy, national, and international	
Louis H. Bean and J. P. Cavin.....	171-197	relations.....	184-191
Meat production with intensive cropping in		Monopotassium phosphate, value as fertilizer	
Corn Belt.....	141-142	material.....	513
Mechanical measures of erosion control. M. L.		Moody soil area, description.....	1079
Nichols and T. B. Chambers.....	646-665	MORGAN, M. F.: The Soil Requirements of	
MEHRING, ARNON L.: Mixed Fertilizers.		Economic Plants. With J. H. Gourley and	
With William H. Ross.....	522-545	J. K. Ableiter.....	753-776
Melbourne soil area, description.....	1045	Mortgages, farm—	
Memphis soil area, description.....	1067-1068	financing—	
Men and soils—summary. Gove Hambridge.....	1-44	aid to soil conservation and farm owner-	
Merrimac loam, potash content.....	398	ship.....	274-278
MERZ, ALBERT R.: Fertilizer Materials. With		terms and conditions.....	158-162
Oswald Schreinder and B. E. Brown.....	487-521	influence on soil misuse.....	9, 16-17
Mesquite grasses, indicators of soil series.....	848-849	interest rates, handicaps to farmers.....	161-162
Metabolism, animal, waste products.....	449	reform methods.....	16-17
		relation to soil depletion and tenancy.....	158-163
		See also Loans, farm.	

	Page
Morton soil area, description.....	1083-1084
Muck—	
areas, description.....	1128-1133
drainage problems.....	726-727
effect upon soil, and preparation.....	517-518
Everglades areas, description.....	1131-1132
northern areas, description.....	1130
Pacific coastal valley areas, description.....	1132
Soils, formation and characteristics.....	975
southeastern Atlantic Coastal Plain areas, description.....	1130-1131
See also Bog.	
Muhlenbergia, indicator of soil series.....	848
Mulch, soil or dust, use in subhumid regions.....	905-906
MUNNS, E. N.—	
Forests for Erosion Control. With John F. Preston and Ivan H. Sims.....	609-614
Management of Forest Soils. With Ivan H. Sims and John T. Auten.....	737-750
The Problem: The Nation As a Whole. With E. J. Utz, Charles E. Kellogg, E. H. Reed, and J. H. Stallings.....	84-110
The Remedies: Policies for Public Lands. With Earle H. Clapp, I. H. Sims, George S. Wehrwein, and C. F. Clayton.....	223-240
MUSGRAVE, G. W.: Grass and Other Thick- Growing Vegetation in Erosion Control. With C. R. Enlow.....	615-633
Muskingum soil area, description.....	1043- 1044, 1121-1122, 1123-1124
Mussels, fertilizer value.....	517
Myrcorrhiza, occurrence in forest soils.....	945-946
MYER, D. S.: The Remedies: Direct Aids to Farmers. With O. V. Wells and J. P. Cavin.....	279-288
Myxomycetes, activities and function in soil.....	946
Nassau soil area, description.....	1035-1036
Nation—	
and the Soil.....	45-318
and the Soil, summary.....	3-19
National—	
forests—	
acreage and importance.....	13-14
administration, problems.....	226-231
soil use, technique.....	226-228
vegetation management, technique.....	226-230
zoning regulations.....	14
progress, relation to soil conservation pro- gram.....	3-19
Nationalism, effect upon farmer.....	873
Navajo soil area, description.....	1098
Navigation, effect of soil erosion on.....	103-110
Nebish soil area, description.....	1029
Needle-and-thread grass, indicator of soil series.....	844, 845-846
Nematode—	
disease, control by rotation.....	415
root knot, control by rotations.....	416
stem, control by rotations.....	415
Nevada Agricultural Experiment Station, work with soil nutrients.....	490-491
New England States, tax-delinquent land, re- version.....	232
New Jersey Agricultural Experiment Station, soil-fertility experiments, long-term.....	485
New York Agricultural Experiment Station, formula for compost.....	464
New York, Wyoming Co., crop-productivity ratings, index numbers.....	1014-1015
Newton soil area, description.....	1115-1117
Newtonia soil area, description.....	1055
Nez Perce soil area, description.....	1055
NICHOLS, M. L.: Mechanical Measures of Erosion Control. With T. B. Chambers.....	646-665
Nickel, effects on plant development.....	824
Niggerwool, indicator of soil series.....	847-848
Nikiforoff, Constantin C.: Soil Organic Mat- ter and Soil Humus.....	929-939
Nimrod soil area, description.....	1074-1075
Nitrate—	
content of soil—	
effect of corn crop.....	349-350, 352
effect of wheat crop.....	350-351
nitrogen, loss in soil.....	349-351, 371

	Page
Nitrate—Continued.	
of soda. See Sodium nitrate.	
problem, peculiarity in dry farming.....	680-682
utilization, effect of tillage.....	325
Nitrates—	
characteristics as fertilizers.....	493
in soils, rapid chemical test, reactions in- volved.....	477
utilization by plants.....	373
Nitrification, effect of tillage.....	325
Nitrites, utilization by plants.....	373
Nitrogen—	
addition to soil by—	
legumes.....	434
rainfall.....	364
availability in fertilizer materials, tests.....	495-496
compounds—	
chemical changes in soil.....	373-376
classification.....	25
content of—	
harvested crops.....	371
manure, function, and value.....	448
mixed fertilizer.....	538
principal commercial fertilizer materials.....	497
cycle, explanation.....	362-363
distribution by soil groups.....	365-367
effect on chemical composition of wheat.....	794
entrance into soil.....	363-365
essential in soil fertility.....	20, 21
factor in fertility maintenance.....	361, 370
fertilizer materials—	
classification.....	493-495
composition and relative merits.....	496-498
description and uses.....	506-512
fixation—	
by <i>Azotobacter</i> , importance.....	943-944
factors affecting.....	356, 357, 363-365
in soil by bacteria.....	943-944, 965
forms utilized by plants.....	373
importance in soil fertility maintenance.....	361
in soil—	
Oswald Schreiner and B. E. Brown.....	361-376
amount, relation to temperature.....	367-369
content by soil groups.....	366-367
distribution by depth.....	369-370
quantity per acre.....	370
rapid chemical tests, reactions involved.....	476-477
level, maintenance in soil.....	355-356, 368-369
losses in soil, causes.....	369, 370-372
role in plant and animal life.....	361-362
soil, interrelation with minerals and organic matter.....	355-357
sources.....	362, 363-365
synthetic organic compound, value as nitro- gen carrier.....	481
use in mixed fertilizers.....	536-537
water-insoluble, availability and activity, tests.....	496
Nitrogenous fertilizer materials, calculated equivalent acidities and basicities.....	520-521
Noncalic Brown soils—	
characteristics, environment, and use.....	997
classification.....	993
description.....	1095-1098
Norfolk—	
sand area, description.....	1071-1072
soil area, description.....	1068-1071
Northwest, land-use adjustment projects.....	236
Nucleoproteins, decomposition process.....	374-376
Nueces sand area, description.....	1136-1137
Nutrition—	
animal, major elements in some soil relation- ships. C. A. Browne.....	777-806
major elements of, relation to soil deficien- cies.....	799-806
plant, major elements in some soil relation- ships. C. A. Browne.....	777-806
Oak—	
chestnut, indicators of soil series.....	841
indicator of soil series.....	841-842
shinnery, indicator of soil series.....	844
Oat scab, control, effect of tillage.....	325-328
Oats—	
chemical composition—	
changes, relation to water supply.....	793

	Page		Page
Oats—Continued.		Peas—	
chemical composition—continued.		cannery, fertilizer application, recommenda-	
effect of soil types.....	783	tions.....	562
yields, and ash content, effect of cropping.....	784	soil requirements.....	775
harvested, nitrogen content.....	371	Peat—	
potash content.....	399	areas, description.....	1128-1133
soil requirements.....	758-759	character, composition, and soil value.....	952
value as green manure.....	438-439	drainage problems.....	726-727
Objectives, agricultural, summary.....	1-2	effect upon soil, and preparation.....	517-518
Ohio Agricultural Experiment Station—		Everglades areas, description.....	1131-1132
experiments with—		moisture-holding capacity.....	468
litter.....	451	moss, use and value as litter.....	451
manure.....	457, 459-460, 461	northern areas, description.....	1130
soil-fertility experiments, long-term.....	485	Pacific coastal valley areas, description.....	1132
Oklahoma, land-use adjustment projects.....	236	soils, formation and characteristics.....	975
Oklahoma Agricultural Experiment Station—		southeastern Atlantic Coastal Plains areas,	
experiments with green manures.....	439	description.....	1130-1131
experiments with phosphorus.....	473	use, description, imports, and production.....	464,
OLMSTEAD, L. B.: Water Relations of Soils.		465, 467	
With W. O. Smith.....	897-910	Pedalfer soils, classification.....	982-983, 989-990, 993-994
Olympic soil area, description.....	1045	Pedocal soils—	
Onion bulb rot, control by rotations.....	415	classification.....	982-983, 989-990, 993
Onions—		description and regions.....	970-971
harvested, nitrogen content.....	371	Pelan soil area, description.....	1112-1113
soil requirements.....	775	Peneplains, soils.....	969
Ontario soil area, description.....	1044-1045	Penn soil area, description.....	1047-1048
Ontonagon soil area, description.....	1026-1027	Pennsylvania Agricultural Experiment Sta-	
Orchard fruits, soil requirements.....	765-769	tion—	
Organic—		experiments in soil fertility, long-term.....	484-485
amendments, nature and use. Irvin C.		experiments with manure.....	461
Feustel.....	462-468	Pennsylvania State College, drainage experi-	
materials, use in maintaining soil fertility.....	22-24	ments.....	724
matter in soil—		People. <i>See</i> Population.	
and soil humus. Constantin C. Nikiforoff		Peppers, soil requirements.....	776
.....	929-939	Percolation, soil water, description of process.....	906
chemical changes.....	373-376	Permanganate methods for determining avail-	
composition.....	915, 930-931	ability of nitrogen.....	495-496
decomposition process.....	941-943	Perrine soil area, description.....	1122-1123
description.....	940-941	Phosphate—	
effect on run-off from fallow and cropped		calcined, preparation and value as fertilizer	
soil.....	622	materials.....	513
gains and losses during 17 years.....	360	rock, occurrence and value as fertilizer ma-	
importance.....	432-433	terial.....	513-514
index to land values and crop yields.....	352	Phosphates—	
influence of mineral level.....	357	organic, effectiveness as fertilizer materials,	
interrelation with nitrogen and minerals.....	355-357	comparison with inorganic.....	498-499
losses and restoration. William A. Al-		relative merits as fertilizer materials.....	502-503
brecht.....	347-360	Phosphatic fertilizer materials—	
maintenance by grass cover.....	621-622	classification.....	498-502
maintenance or increase.....	353-355	description and uses.....	512-515
maintenance problem.....	353-355, 368-369	relative merits.....	502-503
mineralization.....	930-931, 932, 933, 939	Phosphoric acid—	
moisture-holding capacity.....	468	compounds, classification.....	498-502
relation to soil productivity.....	938-939	content of fertilizer materials.....	502
restoration program.....	357-360	importance to plant growth.....	923
sources.....	463-466	Phosphorus—	
matter in virgin soil, depletion.....	349-352	absorption, relative ability of plants.....	385-390
Orthoclase, composition and compounds.....	918-919	accumulation in soil by fertilizer applica-	
Overgrazing, control on national forest range		tion.....	392-393
lands.....	228, 230	applied, availability, means of increasing.....	393-395
Pacatonica, Ill., farm plan for cooperative ero-		availability—	
sion control.....	675-676	and utilization in fertilizers.....	390-395
Pacific coast soils, phosphorus content.....	381	in soils.....	384-385
Pacific Northwest, land-use adjustment proj-		influence of liming.....	388-390
ects.....	236	balance in soils, 1930.....	384
Palouse soil areas, description.....	1079-1080	compounds—	
Panama Canal Zone—		classification.....	26
Frijoles soil area, description.....	1147-1148	in soil.....	387-388
Gatun soil area, description.....	1147-1148	content, soil groups.....	380-381
soils of, description.....	1147-1148	deficiency and soil fertility. W. H. Pierre.....	377-396
Panoche soil area, description.....	1098-1099	essential in soil fertility.....	20, 21-22
Parnell soil area, description.....	1075-1076	factor in fertility maintenance.....	377-380
Parsons soil area, description.....	1102-1104	fertilizers, residual effect.....	391-392
Pasture management in livestock production.....	617-619	fixation in soil, methods.....	393-395
Pastures—		importance in crop production.....	377
erosion control by mechanical measures.....	656-658	in soil—	
established, fertilizer-application, recom-		depletion by crop production and	
mendations.....	561	erosion.....	381-384
improvement with fertilizer, lime, and seed.....	628-629	rapid chemical tests used in United States.....	476
Paxton soil area, description.....	1031-1032	requirements, relation to soil conservation.....	395-396
Pea, Austrian winter, value as cover crop.....	440, 441	role in plant and animal life.....	377
Peaches, soil requirements.....	768	testing, work of Tennessee Valley Author-	
Peanuts, soil requirements.....	765	ity.....	202-203
Pears, soil requirements.....	768-769	Pierre, W. H.: Phosphorus Deficiency and	
		Soil Fertility.....	377-396
		Pierre soil area, description.....	1125-1126



	Page		Page
PIETERS, A. J.: The Use of Cover and Green-		Plymouth soil area, description.....	1030-1031
Manure Crops. With Roland McKee.....	431-444	Poa, indicator of soil series.....	849
Pine—		Podzol soils—	
indicator of soil series.....	840, 842, 854	characteristics, environment, and use.....	997
jack, indicator of soil series.....	840	classification.....	993
loblolly, indicator of soil series.....	842	description.....	1020-1021
longleaf, indicator of soil series.....	842	phosphorus content.....	381
ponderosa, indicators of soil series.....	854	profiles, formation and characteristics.....	972-973
red, indicator of soil series.....	840	shallow, forested, description.....	1124
slash, indicator of soil series.....	842	Pomaces, vegetable and fruit, preparation and	
southern, indicator of soil series.....	842	use as fertilizer materials.....	512
white, indicator of soil series.....	840, 853	Pond soil area, description.....	1118-1119
<i>See also</i> Conifers; also under specific kinds		Pontotoc soil area, description.....	1073
Pittsfield soil area, description.....	1044-1045	Poplar, yellow, indicators of soil series.....	841
Placenta soil area, description.....	1096-1097	Population—	
Plainfield soil area, description.....	1046-1047	farm, migration trends.....	48-54
Planosol—		fluctuations, relation to soil resources, dis-	
meaning of term.....	991	cussion.....	47-55
soils—		migration habits, relation to resettlement	
characteristics, environment, and use.....	1000	policies.....	253-256
classification.....	995	physical variations, effect of soil.....	864-866
description.....	1101-1106	shifts, adjustment problems resulting.....	873-875
formation.....	966, 968, 975	Porcupine grass, indicator of soil series.....	844
Plant—		Porters soil area, description.....	1045-1046
communities, growth conditions, indicators		Portneut soil area, description.....	1099-1100
of soils.....	855-856	Portsmouth soil area, description.....	1110-1112
composition, factors affecting.....	36-37	Potash—	
cover, indicator of climate, soils, and land		consumption, by States.....	401
use.....	835	content in—	
development—		plants.....	399
effect of neglected soil constituents. J. E.		soils, and depth.....	398
McMurtrey, Jr., and W. O. Robinson.....	807-829	cycle, explanation.....	404-405
secondary elements necessary, reference		fertilizers, sources.....	400-401
list.....	812-829	fixation in soil.....	404-405
diseases—		in soils, rapid chemical tests, reactions in-	
control by rotations.....	414-417	volved.....	477
control effects of tillage.....	325-326	magnesia, sulphate of, description, prepara-	
relation to soil deficiencies.....	37	tion, and value.....	515
food—		production in United States, comparison	
constituents and production.....	348-349	with imports, 1934-36.....	491-492
content of fertilizers, changes.....	523-524	sources adaptable to fertilizer use, value.....	515-516
Plant foods, in fertilizers, comparative costs.....	541-543	supply in United States, effect of World War.....	491
growth—		<i>See also</i> Potassium.	
elements essential to.....	911-912	Potassic fertilizer materials—	
factors affecting.....	855-856	description and uses.....	515-516
importance of soil structure.....	895-896	Potassium—	
influence of soil texture.....	894	chloride—	
relation to moisture capacity of soils.....	700-702	description and preparation.....	515
relation to soil pH value, chemical factors		use in fertilizer.....	400-401
underlying.....	925	compounds—	
relationship to soil.....	35-38	contents.....	26
juices, mineral ingredients, analyses.....	780-782	description and value as fertilizer mate-	
life, soil relationships.....	777-779	rials.....	515-516
nutrients—		consumption.....	401
available, estimation.....	922	effects on plant growth and quality.....	401-404
in soil, annual losses.....	99	essential in soil fertility.....	22
in soil, loss and restoration.....	347-360	in soil—	
in soil, losses, factors affecting.....	86-89	rapid chemical tests used in United States.....	476
in soil, requirements.....	754, 755	relation to soil fertility. H. P. Cooper,	
losses in drainage waters.....	87	Oswald Schreiner, and B. E. Brown.....	397-405
natural storage in soil.....	347-348	nitrate, description and value as fertilizer	
renewal in soil solution.....	920-921	material.....	510
nutrition, major elements—		permanganate, use in determining availabil-	
in some soil relationships, C. A. Browne.....	777-806	ity of nitrogen.....	495-496
relation to soil deficiencies.....	790-800	quantity in soils.....	398
Relationships and the Soil.....	751-860	removal by crops.....	399
roots, soil-binding value.....	623	requirements by various crops.....	403-404
tissues, mineral ingredients, analyses.....	780-782	sources and distribution.....	397-398
Plants—		sulphate—	
as soil indicators. H. L. Shantz.....	835-860	description, preparation, and value.....	515
common and scientific names, list.....	857-860	use in fertilizer.....	400-401
economic, soil requirements for. M. F.		<i>See also</i> Potash.	
Morgan, J. H. Gourley, and J. K. Ableiter.....	753-776	Potato—	
growing, relation to soil acidity.....	570-575	crop, fertilizer grades used and application.....	539
nonleguminous, value as green-manure crops.....	433-434	leaves, chemical composition, effect of bal-	
physiological and ecological balance with		anced fertilizer treatment, experiments.....	796, 797
soils.....	835-840	Potatoes—	
recommended for use in erosion control.....	629-633	effect of potassium fertilizers.....	402
relative ability for phosphorus absorption.....	335-390	fertilization application, recommendations.....	559
selenium content, analyses.....	833-834	harvested, nitrogen content.....	371
Plowing, objectives.....	329-335	potash content.....	399
Plows, kinds and uses.....	329-335	soil requirements.....	769
Plums, soil requirements.....	769	varieties grown under similar soil conditions,	
		chemical analyses.....	785

	Page		Page
Potter soil area, description.....	1126	Pumping plants, operation and problems.....	695
Power, electric, possibilities for agriculture....	869	Putnam soil area, description .....	1104
Prairie—		Quartzite, formation and weathering.....	952
grasslands, indicators of soil series.....	843-844	Race, relation to soil.....	870
soils—		Radium, effects on plant development.....	824
alluvial, description.....	1135	Rain water, movement in dry soil.....	902, 905
characteristics.....	971	Rainfall—	
characteristics, environment, and use.....	997	addition of nitrogen to soil.....	364
classification.....	993	amounts, relation to soil and plant types....	838-840
description.....	1052-1057	diversion measures.....	647-662
location and nitrogen content.....	366	effect on—	
nitrogen content.....	366	chemical content of hays.....	806
phosphorus content.....	381	soil formation.....	962
PRESTON, JOHN F.: Forests for Erosion Control.		interception by vegetation for soil surface	
Sims. With E. N. Munns and Ivan H.		protection.....	620-621
Sims.....	609-614	utilization in dry farming.....	683-690
Price—		variations—	
deflation, 1800-1937.....	179-181	effect on mineral composition of rivers..	779-880
inflation, 1800-1937.....	179-181	in Great Plains region.....	69-70
relations, cause of soil misuse. Louis H.		Ramona soil area, description.....	1096-1097
Bean, J. P. Cavin, and Gardiner C.		Range—	
Means.....	171-197	land—	
Prices—		misuse, results.....	73-76
agricultural—		soil use and vegetation management.....	228-230
instability.....	171-172, 179-184	public domain, use, recommendations.....	224-225
reaction to decline in consumer buying		Ranges, erosion-control measures.....	658
power.....	196	Raspberries, soil requirements.....	769
farm, instability due to inflation and defla-		Rayne soil area, description.....	1048
tion.....	179-181	Reagan soil area, description.....	1094
fertilizers, factors affecting.....	540-543	Real estate, farm—	
inflexibility, discussion.....	195-197	index of value per acre in Missouri, 1820-1930.	120
wheat, effects of easy credit.....	273	rent, capitalized, and value, 1921-36.....	123
Processing taxes, collection, litigation affect-		rent per acre and value in Iowa, 1900-1936..	122
ing.....	305-306, 308-311	Reclamation—	
Property—		program, description.....	256-259
deferred-yield, taxing, recommendations..	269-270	projects, failures, consequences.....	73
inheritance, statutes and results.....	115-119	projects, planning and operation.....	258-259
reverted for default of taxes, ownership and		value in arid areas.....	15-16
administration.....	232-234	Red soils—	
rights in forest land management in Europe.	133-	formation and characteristics.....	973, 974
136		nitrogen content.....	366
tax delinquency, reversion of land, factors		phosphorus content.....	381
governing.....	232-234	Red Desert soils—	
taxation on, reforms needed.....	265-271	characteristics and formation.....	971
Protocolzo, occurrence and function in soils.	946, 965	characteristics, environment, and use.....	996
Providence, N. C., farm plan for cooperative		classification.....	993
erosion control.....	671, 674	description.....	1100-1101
Prowers soil area, description.....	1089	of Hawaiian Islands, description.....	1155-1157
Public—		Red Podzolic soils—	
aid, cause of land misuse.....	125-129	characteristics, environment, and use.....	998
domain—		classification.....	994
character use, and improvement.....	223-225	description.....	1058-1075
extent and value.....	13	formation and characteristics.....	974
lands, purchases through Farm Security		formation, effect of humidity.....	962
Administration.....	247-248	Red Podzolic Lateritic soils, in Puerto Rico,	
new, ownership and administration.....	232-234	description.....	1138-1140
overgrazing.....	114	Redding soil area, description.....	1104-1105
settlement.....	112-113, 123	Reddish Brown soils—	
works, expansion by Government for de-		characteristics, environment, and use.....	996
pression cure.....	189-191	classification.....	993
Puerto Rico—		Reddish-Brown Lateritic soils—	
Alonso soil area, description.....	1138-1139	characteristics, environment, and use.....	998
Aquilita soil area, description.....	1144-1145	classification.....	994
Bayamón soil area, description.....	1140-1142	formation, effect of humidity.....	962
Catalina soil area, description.....	1138-1139	in Puerto Rico, description.....	1140-1142
Coamo soil area, description.....	1142-1143	of Hawaiian Islands, description.....	1154-1155
Coloso soil area, description.....	1146-1147	Reddish Brown soils—	
Coto soil area, description.....	1140-1142	description.....	1092-1095
Descalabrado soil area, description.....	1145-1146	of Hawaiian Islands, description.....	1155-1157
Guayama soil area, description.....	1145-1146	Reddish Chestnut soils—	
Lares soil area, description.....	1139-1140	characteristics, environment, and use.....	997
Los Guineos soil area, description.....	1138-1139	classification.....	993
Múrcara soil area, description.....	1146	description.....	1085-1088
Naranjito soil area, description.....	1146	in Puerto Rico, description.....	1142-1143
Nipe soil area, description.....	1142	Reddish Prairie soils—	
Paso Seco area, description.....	1143-1144	characteristics, environment, and use.....	997
Ponceña soil area, description.....	1142-1143	classification.....	993
Rosario soil area, description.....	1142	description.....	1057
Sabana Seca soil area, description.....	1139-1140	Redwoods, indicators of soil series.....	853
San Anton soil area, description.....	1146-1147	REED, E. H.: The Problem: The Nation As a	
Santa Isabel soil area, description.....	1143-1144	Whole. With E. J. Utz, Charles E. Kellogg,	
sols, of description.....	1137-1147	J. H. Stallings, and E. N. Munns.....	84-110
Soller soil area, description.....	1144-1145	Reeves soil area, description.....	1100-1101
Toa soil area, description.....	1146-1147		
Pullman soil area, description.....	1086, 1088		

	Page	Rotation, crop—Continued.	Page
Reforestation—		advantages.....	410-412
areas under restoration for watershed protec-		combining with strip cropping.....	644-645
tion.....	614	dry-land practices in Great Plains.....	427-428
importance of soil fertility.....	227	in—	
in erosion control, limiting factors.....	611-613	Corn Belt.....	420-422
status and prospects.....	613-614	Cotton Belt.....	423-424
value in rehabilitation of forest soil.....	748-750	dairy region.....	424-425
Refrigeration, farm and community, import-		Iowa.....	422
ance.....	869	wheat regions.....	425-427
Refuges, wildlife, restoration and increase.....	80-83	South, needs.....	143-145
Relief, direct, extent and payments.....	126-127	on Indiana farms, 1930.....	421
Rendzina soils—		practices in irrigation agriculture.....	428-429
area, description.....	1106-1110	practices in soil-moisture control program.....	690-692
characteristics, environment, and use.....	1001	recommendations for South.....	145
classification.....	995	relation to soil fertility.....	409-412
humid and semiarid, in Puerto Rico, descrip-		use in erosion control on farms.....	625
tion.....	1144-1145	Rotations—	
Renfrow soil area, description.....	1057	adaptations to erosion control devices.....	420
Rent, farm real estate—		control of plant diseases.....	414-417
and proportion of value, in Iowa, 1900-1936.....	122	crop sequence, effect on yields.....	430
capitalized, and proportion of value, 1921-36.....	123	dry-land, practices.....	427-428
Research—		effect on—	
part in soil conservation program.....	12-13	erosion control.....	419-420
remedy for soil misuse. C. W. Warburton,		weed control.....	417-419
C. B. Manifold, Charles E. Kellogg, and C.		factors controlling.....	406-409
P. Barnes.....	198-222	5-year, example.....	409
Reseeding, factor in pasture improvement.....	628-629	planning and modification.....	408-409
Resettlement—		practices, by regions.....	420-430
part in soil conservation program.....	15	systematic, value.....	406
rural, program, objectives.....	253-256	use in maintaining soil fertility.....	22-24
Revenues, rural communities, requirements		value of legumes.....	412-414
for.....	266-267	Roth, W. J.: The Causes: Defects in Farming	
Rice, T. D.: The Physical Nature of Soil.....		Systems and Farm Tenancy. With M. R.	
With L. T. Alexander.....	887-896	Cooper, J. G. Maddox, R. Schickele, and H.	
Rice, soil requirements.....	759	A. Turner.....	137-157
Richfield soil area, description.....	1086	Rothamsted Experiment Station, England—	
Ritzville soil area, description.....	1090-1092	work with chemical composition of plants.....	794-795
Rivers, mineral content, composition, effect of		work with green manures.....	439
high and low rainfall.....	779-780	work with phosphate rock.....	500
ROBINSON, W. O.: Neglected Soil Constituents		Rubicon, soil area, description.....	1027-1029
That Affect Plant and Animal Development.		Rubidium, effects on plant development.....	824
With J. E. McMurtrey, Jr.....	807-829	Run-off measurements, of Shelby loam.....	419
Rock land soil area, description.....	1122-1123	Russell soils, development.....	968
Rocks—		Ruston soil area, description.....	1069-1071, 1072
breaking by ice and plant roots.....	955	Rye—	
carbonation.....	958	harvested, nitrogen content.....	371
eolian, composition, and soil nutritive value.....	951	potash content.....	399
exfoliation, description of process, and im-		scab, control, effect of tillage.....	325-326
portance.....	953-955	soil requirements.....	759
glacial, character, composition, and soil		value as—	
value.....	951-952	cover crop.....	440, 441
grinding by rivers and ice.....	955-956	green manure.....	438-439
hydrolysis.....	957-958, 962, 973-975	Sagebrushes, indicators of soil series.....	848, 850-851
igneous—		Sagemoor soil area, description.....	1099-1100
formation, composition, and weather-		St. Paul soil area, description.....	1087-1088
ing.....	949-950	Salad crops, soil requirements.....	776
mineral composition.....	918	Saline soils, classification.....	994
kinds, description, formation, and weather-		Salt, fertilizer value and use.....	516
ing.....	949-953	SALTER, ROBERT M.—	
metamorphic, formation, kinds, and weather-		Farm Manure. With C. J. Schollenberger.....	445-461
ering.....	952-953	Methods of Applying Fertilizers.....	546-562
mineral elements in.....	778	San Joaquin soil area, description.....	1104-1105
oxidation and reduction.....	958	Sand dunes, composition, value, and damage.....	951
relation to soils.....	953	Sandgrasses, indicators of soil series.....	844
sedimentary, characteristics, composition,		Sands—	
and weathering.....	950-951, 952	dry—	
weathering—		characteristics, environment, and use.....	1001
by winds, landslides, and avalanches.....	956	classification.....	995
chemical.....	954, 957-958	description.....	1135-1137
primary physical.....	953-955	loose, of Hawaiian Islands, description.....	1159
secondary physical.....	955-956	Sandstones, mineral composition.....	918
Rodents, effect upon soil.....	946-947, 964-965	Santa soil area, description.....	1038
ROOSEVELT, FRANKLIN D., President, land		Sassafras—	
policy.....	115	fine sandy loam, potash content.....	398
ROOSEVELT, THEODORE, President, timber-		sand, potash content.....	398
land policy.....	113	soil area, description.....	1048-1049
Root—		soils, derivation.....	973
nodule organisms, function.....	944	SAUNDERSON, M. H.: The Remedies: Policies	
zone, water capacity, factors affecting.....	707-708	for Private Lands. With George S. Wehr-	
Roots, soil-binding value.....	623	wein, Clarence I. Hendrickson, Philip M.	
Rosebud soil area, description.....	1082-1083	Glick, Carl C. Taylor, Francis R. Kenney,	
Roselawn soil area, description.....	1027-1029	and Marshall Harris.....	241-264
ROSS, WILLIAM H.: Mixed Fertilizers. With		Savannah soil area, description.....	1072
Arnold L. Mehring.....	522-545		
Rotation, crop—			
Clyde E. Leighty.....	406-430		

	Page		Page
Scab disease, on cereals, control effects of tillage.....	325-326	Soil—	
SCHICKLE, R.: The Causes: Defects in Farming Systems and Farm Tenancy. With M. R. Cooper, W. J. Roth, J. G. Maddox, and H. A. Turner.....	137-157	a national problem, E. J. Utz, Charles E. Kellogg, E. H. Reed, J. H. Stallings, and E. N. Munns.....	84-110
Schist, derivation and weathering.....	952-953	acidity—	
SCROLLBERGER, C. J.: Farm Manure. With Robert M. Salter.....	445-461	and liming. Emil Truog.....	563-580
SCHREINER, OSWALD—		caused by true acids, tests.....	578-579
Determining the Fertilizer Requirement of Soils. With M. S. Anderson.....	469-486	control by lime.....	570-575
Fertilizer Materials. With Albert R. Merz and B. E. Brown.....	487-521	determinations by quantitative methods.....	576-577
Soil Nitrogen. With B. E. Brown.....	361-376	nature and theories.....	577-579
Soil Potassium in Relation to Soil Fertility. With H. P. Cooper and B. E. Brown.....	397-405	rapid tests.....	575-576
Science, of soil, fundamental relationships.....	38-44	relation to plant growth.....	570-575
SCOFIELD, C. S.—		value and correction.....	914
Drainage in Arid Regions. With James Thorpe.....	717-722	alluvial—	
Soil, Water Supply, and Soil Solution in Irrigation Agriculture.....	704-717	arid western areas, description.....	1135
Seaweed, fertilizer value.....	518	northeastern areas, description.....	1134
Selaginella, indicator of soil series.....	848	Prairie and Chernozem belt areas, description.....	1135
Selenium—		southern areas, description.....	1134-1135
effects on animal and plant development.....	825	amendments, tests, greenhouse methods.....	480-482
in soils. K. T. Williams.....	830-834	analysis, chemical and physical, from dust storm, Feb. 6, 1937.....	591
poisoning, research.....	38	and—	
Sewage sludge, preparation and value as fertilizer material.....	510	crop varieties, comparative influences on yield and chemical composition.....	786-787
Shales—		Plant Relationships.....	751-860
composition.....	951, 953	society. Charles E. Kellogg.....	863-886
mineral composition.....	918	the Farmer.....	319-750
Shantung Brown soils. See Noncalcic Brown soils.		the law. Philip M. Glick.....	296-318
SHANTZ, H. L.: Plants as Soil Indicators.....	835-860	the Nation.....	45-318
Shelby—		area types, value for agricultural production.....	855
loam, run-off and erosion measurements.....	419	associations, of United States, range and types.....	1019-1020
soil area, description.....	1102-1104	behavior, relation to colloid composition.....	927-928
Sierozem soils—		biological activity.....	963-965
characteristics, environment, and use.....	996	blowing, control by preventive cultivation in dry farming.....	682
classification.....	993	categories, grouping by C. F. Marbut.....	983-984, 989-990
description.....	970-971, 1098-1100	characteristics and deficiencies, relation to diet.....	864-866
regions.....	970-971	chemical properties, effect upon soil water.....	908
Sierra soil area, description.....	1097-1098	chemistry—	
Silicon—		Horace G. Byers, M. S. Anderson, and Richard Bradfield.....	911-928
compounds, occurrence in soils.....	911	elements.....	911-916
effects on animal and plant development.....	825	research, problems and nature.....	915-916
Silver, occurrence and effects on plant growth.....	825	technical.....	916-928
Silviculture—		classification—	
practices in national forests.....	229	Mark Baldwin, Charles E. Kellogg, and James Thorp.....	979-1001
value in rehabilitation of forest soil.....	747-748	development in United States.....	981-984
SIMS, I. H.—		higher categories.....	986-989
Forests for Erosion Control. With E. N. Munns and John F. Preston.....	609-614	system, development in Russia.....	881
Management of Forest Soils. With E. N. Munns and John T. Auten.....	737-750	units.....	984-986
The Remedies: Policies for Public Lands. With Earle H. Clapp, E. N. Munns, George S. Wehrwein, and C. F. Clayton.....	223-240	color, importance and causes.....	892-893
Sites soil area, description.....	1058	complex, mapping.....	889
Slag, basic, value as fertilizer material.....	501, 502, 512	components, solid, liquid, and gaseous.....	891-892
Slums, rural, clearance projects.....	53-55	conditions, essential for crop plants.....	753-755
SMITH, NATHAN R.: Fauna and Flora of the Soil. With Charles Thom.....	940-947	conservation—	
SMITH, W. O.: Water Relations of Soils. With L. B. Olmstead.....	897-910	benefits from mortgage financing.....	274-278
Smith-Lever Act, aid to extension work.....	199	cooperative programs among farmers.....	200-202
Snow surveys, importance in irrigation farming.....	698-699	costs and benefits.....	58
Society and soil. Charles E. Kellogg.....	863-886	demonstrations, description.....	205-211
Sod crops, value in soil maintenance and moisture storage.....	358-359	demonstrations, effectiveness and limitations.....	210-211
Sodium—		demonstrations, objectives.....	206
chloride—		districts, laws, description.....	248-253
dissociation in soil solution.....	711-712	districts, laws, due process and public purpose.....	302-303
fertilizer value and use.....	516	districts, laws, legislative power, delegation.....	303-305
effects on animal and plant development.....	826	districts, laws, provisions.....	15
nitrate—		districts, laws, State or Federal control, constitutionality.....	299-300
sources, value, and use as fertilizer material.....	511	effect of farm tenancy.....	151-157
use in mixed fertilizers.....	536-537	effect of surface cover.....	619-620
		future national policy.....	56-59
		future possibilities, recommendations.....	287-288
		objectives on Texas watershed area.....	603-606
		program, national scope.....	606-608
		program, need for farm credit expansion.....	271-274
		project in Texas, land treatment.....	603-606
		promising plants for.....	630-633

Soil—Continued.	Page	Soil—Continued.	Page
conservation—continued.		maintenance, benefits of dairy farming.....	139-140
relation to phosphorus requirements.....	395-396	maladjustment of people to, origins of prob-	
value of strip cropping.....	634-645	problem.....	869, 870
constituents.....		management—	
determination.....	469-478	problems.....	216
neglected, effect on plant and animal devel-		program, relation to farmer.....	19-35
opment. J. E. McMurtry, Jr. and W.		maps. <i>See</i> Maps.	
O. Robinson.....	807-829	material, air, and water, relative volumes.....	903-904
uncommon, determination.....	477-478	methods of placing fertilizers in.....	550-555
cropped, effect of organic matter on run-off		microbial populations, balanced.....	946, 947
and erosion.....	622	microbiology, field for research.....	215
decomposition, organisms causing.....	934	mineral composition.....	916-919
deficiencies—		misuse—	
effects.....	20-22	causes.....	7-11
relationships of major elements to nutri-		causes in traditional attitudes and institu-	
tion.....	799-806	tions. L. C. Gray, John B. Bennett,	
depletion—		Erich Kraemer, and W. N. Sparhawk.....	111-136
effect of cotton farming.....	143-145	effect of traditional attitudes and institu-	
relation to farm mortgage.....	158-163	tions. L. C. Gray, John B. Bennett,	
development—		Erich Kraemer, and W. N. Sparhawk.....	111-136
history.....	887-888	on irrigation projects, results.....	72-73
on profiles of steep slopes, stunting,		problems.....	4-7
causes.....	966	relation to size of farm.....	146-148
effective use, comparison with problems of		remedies and preventives.....	11-19
industrial worker.....	197	remedies in education and research. C.	
elements.....		W. Warburton, C. B. Manifold, Charles	
necessary for plant and animal growth.....	807-812	E. Kellogg, and C. P. Barnes.....	198-222
secondary, necessary for plant and animal		remedies in policies for public lands.	
development, reference list.....	812-829	Earle H. Clapp, E. N. Munns, I. H.	
enrichment by addition of organic matter.....	462-	Sims, George S. Wehrwein, and C. F.	
464, 466-468		Clayton.....	223-240
erosion—		remedy by direct aids to farmers. O. V.	
demonstration project, typical.....	206-209	Wells, J. P. Cavin, and D. S. Myer.....	279-288
<i>See also</i> Erosion, soil.		remedy by economic stabilization. O. V.	
fallow, effect of organic matter on run-off		Wells and Bushrod W. Allin.....	289-295
and erosion.....	622	result of defects in farming systems and	
fauna. Charles Thom and Nathan R.		farm tenancy. M. R. Cooper, W. J.	
Smith.....	940-947	Roth, J. G. Maddox, R. Schickele, and	
fertility. <i>See</i> Fertility, soil.		H. A. Turner.....	137-157
fertilizer needs—		result of imperfections in agricultural fi-	
determination by biological methods.....	478-479	nance. David L. Wickens, R. Clifford	
determination by field experiments.....	482-483	Hall, and Donald Jackson.....	158-170
determination by laboratory means.....	469-478	result of price relations and economic in-	
determination by pot and greenhouse		stability. Louis H. Bean, J. P. Cavin,	
methods.....	479-482	and Gardiner C. Means.....	171-197
<i>See also</i> Fertilizers.		moisture. <i>See</i> Moisture, in soil.	
flora. Charles Thom and Nathan R.		morphology, data, need for.....	214
Smith.....	940-947	nitrogen in. Oswald Schreiner and B. E.	
formation—		Brown.....	361-376
H. B. Byers, Charles E. Kellogg, M. S.		organic	
Anderson, and James Thorp.....	948-978	amendments, nature and use. Irvin C.	
and classification.....	42-44	Feustel.....	462-468
effect of climate.....	961-963	decomposition, description.....	348, 368-369
living organisms as a factor.....	963-965	matter. <i>See</i> Organic matter, soil.	
processes.....	969-978	parent materials—	
relief as a factor.....	966-968	effect on type and rate of development of	
genesis, factors.....	948-949	soils.....	959
groups—		residual effects.....	960-961
classification.....	43	formation.....	949-958
delineation on maps.....	988-989	permeability, importance for irrigation.....	708-709
nitrogen content.....	366-367	physical—	
phosphorus content.....	380-381	conditions, changes.....	85-86
potash content and depth.....	398	nature. T. D. Rice and L. T. Alex-	
relation to development of cultural		ander.....	887-896
systems.....	875-878	properties affecting water-holding ca-	
horizons, composition and structure.....	888-891	pacity.....	897-898
humus—		physes, description.....	39-40
and soil organic matter. Constantin C.		plasticity, description.....	907-908
Nikiforoff.....	929-939	porosity, value of forests.....	610
distribution.....	937-938	potassium, relation to soil fertility. H. P.	
improvement—		Cooper, Oswald Schreiner, and B. E.	
by proper tillage.....	322-323	Brown.....	397-405
extension work.....	200-203	problem, relation to Nation.....	3-19
indicators, use of plants. H. L. Shantz.....	835-860	productivity—	
investigations, need for.....	212-217	maintenance factors.....	58-59
liming and acidity. Emil Truog.....	563-580	ratings, preparation.....	1011-1015
losses—		relation to soil organic matter.....	938-939
effects on crop yields.....	96-103	tables, interpretation.....	1012-1013
from areas of clean tillage and dense		variations in Great Plains region.....	69
vegetation, comparison.....	594	profile—	
from grass and row crops on various soil		development, function of plant and animal	
types and land slopes.....	620	life.....	963-965
nature and extent.....	84-96	structure and development.....	888-891
significance.....	89-90	reaction, influence of mixed fertilizers.....	536-537
strip cropping of cotton.....	638-639	reactions to fertilizers, tests.....	24-28

Soil—Continued.	Page	Soils—	Page
relation to—		acid—	
landscape.....	864-867	exchange relations.....	921-923
plant growth.....	35-38	formation.....	579-580
race.....	870	alkalization, discussion of theory.....	976-978
water supply and soil solution in irrigation		alluvial—	
agriculture. C. S. Schofield.....	704-717	characteristics.....	991-992, 995
relationships to plant and animal nutrition,		characteristics, environment, and use.....	1001
major elements. C. A. Browne.....	777-806	classification.....	995
requirements—		description.....	1133-1135
for crop growth.....	35-36	in Puerto Rico, description.....	1146-1147
important crop plants.....	756-776	of Hawaiian Islands, description.....	1159
of economic plants. M. F. Morgan, J. H.		and men, summary. Gove Hambridge.....	1-44
Gourley, and J. K. Ableiter.....	753-776	azonal—	
research, objectives and needs.....	211-217	characteristics.....	969-970, 987, 991, 1001
resources, conservation in relation to national		classification.....	980-981, 995
prosperity.....	3-19	base exchange—	
salinity, changing conditions.....	711	definition, importance, and application.....	913-914
science—		relations.....	921-923
development, European contributions.....	878-880	base-holding capacity, dependence upon	
development, future.....	885-886	colloidal composition.....	927
development, history.....	878-885	biological relationships.....	41-42
development in United States.....	882-885	calcification, description of process and	
development, Russian contributions.....	881-892	regions.....	970-972
Fundamentals.....	861-1016	calomorph, classification.....	995
Fundamentals, summary.....	38-44	characteristics necessary for irrigation.....	706-709
selenium in, toxicity to animals.....	830-831, 833-834	chemical—	
series, indication by vegetation types.....	840-854	composition, description.....	40-41
solution—		nature, data, need for.....	214-215
chemical composition from various types		classification—	
of soils.....	780	early systems.....	980-981
composition, extraction, and role.....	920-921	on basis of characteristics.....	993-995
constituents.....	711-713	use of color terms.....	992
definition and determination of concen-		clay, acidity, reaction on plants.....	571-575
tration.....	710-713	composition, partial, by 1-foot sections.....	780
function and utilization.....	914-915	dealkalization, description of process.....	978
mineral ingredients.....	779-880	desalinization, discussion of theory.....	976-978
physical characteristics.....	712	desurfaced and normal, annual crop yields,	
surveys, need for, and costs.....	213	experiments.....	101
tests, rapid—		dry-land, qualities.....	680
chemical reactions involved.....	476-477	effect of—	
methods.....	473-476	burrowing animals.....	946-947, 964-965
use and value.....	470-472, 478	parent material on.....	958-961
textural classes.....	984-985	electrodialysis, description.....	921-923
type—		extension work for educating farmers.....	198-205
definition of term.....	985	fertilizer requirements—	
phase, definition.....	986	determination. Oswald Schreiner and M.	
types—		S. Anderson.....	469-486
capabilities for use.....	217	<i>See also</i> Fertilizers.	
characterization.....	213-215	forest. <i>See</i> Forest soils.	
drainage needs.....	724-726	gleization, effects.....	975
effect on mineral composition of crops.....	782-783	granulation, restoration.....	908
nitrogen content per acre.....	370	halomorph, classification.....	994-995
slope range.....	986	hydrogen-ion concentration.....	923-926
suitable, determination.....	755-756	hydromorph, classification.....	994-995
water and soil losses when planted to grass		in Kentucky, comparative studies.....	801, 802
and row crops.....	620	internal drainage, effect of rocks.....	959
units, geographic association.....	988-989	intrazonal—	
use—		characteristics.....	969, 987, 991, 999-1001
effects of change in living standards.....	870-871	classification.....	980-981, 995
for public purposes. Carl C. Taylor,		irrigated, need for drainage facilities.....	717-719
Bushrod W. Allin, and O. E. Baker.....	47-59	lateritic—	
virgin forest, characteristics of relation-		classification.....	994
ships.....	737-740	of Hawaiian Islands, description.....	1159
water—		<i>See also</i> Laterite soils.	
absorption, increase by mechanical meth-		laterization, description of process.....	973-975
ods.....	653-654	mineral elements in.....	778
available, storage and conservation.....	904-906	moisture—	
capillary movement.....	898-901, 902, 904-905	capacity, relation to plant growth.....	700-702
effect of soil chemical properties.....	908	content, effect on types of plant growth.....	855
forms.....	901-903	mountainous, age and productiveness.....	969
kinds.....	707	nomenclature.....	985, 989-992
losses, sources and prevention.....	688-689	normal and desurfaced, annual crop yields,	
passage, factors affecting.....	964	experiments.....	101
surfaces, kinds.....	898	of—	
Soil Conservation and Domestic Allotment		Alaska, description.....	1148-1151
Act.....		Hawaiian Islands, description.....	1151-1161
benefits.....	128	national forests, use, technique.....	226-228
grants.....	279	Panama Canal Zone, description.....	1147-1148
provisions.....	17	public domain, condition and proposed	
Soil Conservation Service—		improvement.....	223-225
cooperation with farmer on soil-conservation		Puerto Rico, description.....	1137-1147
plans.....	17, 283-284, 285-286, 287-288	Tropics, characteristics and need for clas-	
educational work for farmers.....	12	sification.....	990-991
experiment stations, crop yields from treated		United States. Soil Survey Division, Bu-	
plots, experiments.....	101-103	reau of Chemistry and Soils.....	1019-1161

Soils—Continued.	Page	Page
of—continued.		
Virgin Islands, description.....	1137-1147	
physical—		
and chemical changes.....	702	
changes under irrigation.....	714-715	
podzolization, description of process.....	971,	
	972-973, 975	
podzolized—		
classification.....	994	
light-colored, classification.....	993-994	
poorly drained, formation.....	975	
relation to rocks.....	953	
relationship with plants.....	835-840	
response to management, determination.....	215-217	
Russian classification.....	980-981	
saline, classification.....	994	
salinization, description of process and re-		
sulting vegetation.....	975-976	
selenium—		
content, analyses.....	831-832	
in..... K. T. Williams.....	830-834	
shallow—		
arid and subhumid areas, description.....	1125-1127	
arid and subhumid, of Hawaiian Islands,		
description.....	1158-1159	
grassland, of Hawaiian Islands, descrip-		
tion.....	1158-1159	
humid, description.....	1120-1125	
humid, in Puerto Rico, description.....	1146	
humid, of Hawaiian Islands, descrip-		
tion.....	1157-1158	
shrinkage, relation to quantity and kind of		
colloid.....	927	
structure, types, description and import-		
ance.....	894-896	
texture, analysis and influence on plant		
growth.....	893-894	
transitional, names.....	978	
water relations..... L. B. Olmstead and W. O.		
Smith.....	897-910	
zonal—		
characteristics.....	969, 987, 991, 996-999	
classification.....	980-981, 993-994	
<i>See also</i> under specific series.		
Solanaceae, soil requirements.....	776	
Solonchak soils—		
characteristics, environment, and use.....	999	
classification.....	994	
description.....	1118-1120	
formation.....	976	
Solonetz soils—		
characteristics and formation.....	977-978	
characteristics, environment, and use.....	999	
classification.....	994	
description.....	1118-1120	
formation.....	976	
Soloth soils—		
change, theory.....	978	
characteristics, environment, and use.....	999	
classification.....	994	
formation.....	978	
Solution cultures, tobacco grown in, key to		
deficiency effects.....	800	
Sorghums, soil requirements.....	760	
South, agricultural opportunities.....	144	
South Dakota Agricultural Experiment Sta-		
tion, soil-fertility experiments, long-term.....	485	
Soybean meal, uses, value, and production,		
1928-36.....	16-17, 619	
Soybeans—		
fertilizer application, recommendations.....	562	
soil requirements.....	765	
SPARHAWK, W. N.: The Causes: Traditional		
Attitudes and Institutions. With L. C.		
Gray, John B. Bennett, and Erich Kraem-		
er.....	111-136	
Speculation—		
in public lands, effects.....	112-113, 120-125	
land, control recommendations.....	125	
Spencer soil area, description.....	1049-1050	
Spinach, soil requirements.....	776	
Springer soil area, description.....	1094	
Spruce, indicator of soil series.....	840, 853	
Stabilization, economic, remedy for land mis-		
use..... O. V. Wells and Bushrod W. Allin.....	289-295	
STALLINGS, J. H.: The Problem: The Nation		
As a Whole. With E. J. Utz, Charles E.		
Kellogg, E. H. Reed, and E. N. Munns.....	84-110	
Standard State Soil Conservation Districts		
Law—		
problems, discussion.....	299-305	
progress.....	251-252	
provisions and recommendations.....	248-251	
relation to Flood Control Act.....	252-253	
Stipa, indicator of soil series.....	849	
Stockmen's cooperative business organization,		
aims.....	245	
Straw—		
cereal, use for litter.....	451	
lack of nitrogen content for use as fertilizer.....	448	
Strawberries, soil requirements.....	770-771	
Strip cropping. <i>See</i> Cropping, strip.		
Strontium, effects on plant development.....	826	
Subhumid—		
areas, problem. John B. Bennett, F. R.		
Kenney, and W. R. Chapline.....	68-76	
regions, conservation policy.....	666-668	
Subsoils, average chemical composition.....	802	
Sugar beet—		
leaf spot, control by rotations.....	416	
nematode, control by rotations.....	416	
Sugar beets—		
fertilizer application, recommendations.....	561	
harvested, nitrogen content.....	371	
soil requirements.....	771-772	
Sugar crops, soil requirements.....	771-772	
Sugarcane—		
chemical composition, climatic effects.....	790-792	
potash content.....	399	
soil requirements.....	771	
varieties grown under similar soil conditions,		
chemical analyses.....	785-786	
Sulphide test for soil acidity.....	575	
Sulphur—		
effects on plant development.....	826-827	
occurrence in fertilizers.....	504	
Sulphuric acid, use in producing superphos-		
phate.....	500	
Summit soil area, description.....	1056	
Sumter soil area, description.....	1108-1109	
Superphosphate—		
ammoniated, description and value as ferti-		
lizer material.....	507	
preparation and value.....	514-515	
production.....	500	
Superphosphates, availability to plants.....	389,	
	390, 392, 393	
Supreme Court—		
decision affecting Agricultural Adjustment		
Act.....	306, 308-311	
personnel changes.....	313	
Surface—		
cover. <i>See</i> Vegetation.		
run-off, prevention in dry farming.....	682-683	
<i>See also</i> Land surface.		
Susquehanna soil area, description.....	1072	
Swamp lands, uneconomic drainage, results.....	78-82	
Sweetclover, value as cover crop.....	440, 443	
Sweetpotato—		
black rot, control by rotations.....	415	
foot rot, control by rotations.....	415	
scurl, control by rotations.....	415	
Sweetpotatoes—		
harvested, nitrogen content.....	371	
potash content.....	399	
soil requirements.....	772	
Talladega soil area, description.....	1123	
Tallahassee County Soil Conservation Associa-		
tion, terracing and soil-improvement work.....	203	
Tama soil area, description.....	1056-1057	
Tannin, preparation and value as fertilizer		
material.....	511	
Tax—		
collection, inequalities.....	169	
delinquency, property reverted, factors gov-		
erning.....	232-234	
reform, recommendations.....	190-191	
<i>See also</i> Taxes.		

	Page		Page
Taxation—		Texas—	
effect on urban and rural enterprise.....	169-170	land-use adjustment projects.....	236
for relief, advantages.....	126	root rot, control by rotations.....	416
land, effects on land use.....	163-170	watershed area, soil-erosion survey.....	603-606
policies during prosperity, recommenda-		Texas Agricultural Experiment Station, soil	
tions.....	190	tests.....	473
rates in Great Plains region.....	72	textures, of soils, changes.....	85-86
reform, principles.....	271	Thallium, effects on animal and plant develop-	
Taxes—		ment.....	827
farm—		THOM, CHARLES: Fauna and Flora of the Soil.	
influence on soil misuse.....	9-10	With Nathan R. Smith.....	940-947
reform methods.....	16	Thornbush, indicator of soil series.....	848
on deferred-yield property, recommenda-		THORNE, CHARLES E., pioneer in soil fertility	
tions.....	269-270	maintenance.....	382
processing, collection, litigation affecting.	303-306,	THORP, JAMES—	
308-311		Drainage in Arid Regions. With C. S.	
property—		Scofield.....	717-722
collection procedure.....	271	Formation of Soil. With H. G. Byers,	
excessive, effect upon community.....	166	Charles E. Kellogg, and M. S. Anderson- 948-978	
faulty administration, results.....	168-169	Soil Classification. With Mark Baldwin	
improvement in administration.....	270-271	and Charles E. Kellogg.....	979-1001
increase, effect on land use.....	163-165	Tifton soil area, description.....	1073
inherent effects.....	165-168	Tillage—	
reduction recommendations.....	265-268	amount, factors determining.....	324-325
reforms needed.....	265-271	effect on—	
real estate in Iowa, 1900-1936.....	122	erosion.....	326-327
<i>See also</i> Tax.		insect control.....	326
TAYLOR, CARL C.—		nitrate utilization.....	325
Public Purposes in Soil Use. With Bush-		nitrification.....	325
rod W. Alin and O. E. Baker.....	47-55	factor in plant-disease control.....	325-326
The Remedies: Policies for Private Lands.		implements, development.....	321-322
With George S. Wehrwein, Clarence I.		machinery—	
Hendrickson, M. H. Saunderson, Philip		R. B. Gray.....	329-346
M. Glick, Francis R. Kenney, and Mar-		effect on cotton and corn crops.....	342-346
shall Harris.....	241-264	methods.....	19-20, 663-664
Taylor Grazing Act—		operations, character and kind.....	323
improvement of public domain.....	225	practices—	
passage.....	115	John S. Cole and O. R. Mathews.....	321-328
regulations on public domain.....	13	in soil-moisture control program.....	690-692
Taylor soil area, description.....	1029	prevention of wind erosion.....	327
Temperature—		purposes.....	19-20, 322-323
effect on—		time, control by seasons.....	323-324
soil formation.....	962-963	Timber—	
types of plant growth.....	855	cutting, effect on forest soil.....	740-741
relation to amount of nitrogen in soils.....	367-369	management on national forests.....	229
Tenancy—		regions, soils, classification.....	993-994
effect of farm financing.....	162-163	Timber and Stone Act, provisions and effects.....	113
farm—		Timberlands on public domain, treatment.....	113
defects, cause of soil misuse. M. R.		Timothy—	
Cooper, W. J. Roth, J. G. Maddox, R.		harvested, nitrogen content.....	371
Schickel, and H. A. Turner.....	137-157	soil requirements.....	762
development.....	148-151	Tishomingo soil area, description.....	1073
effect upon soil conservation.....	151-157	Titanium, effects on plant development.....	827
relation to mortgage.....	158-163	Tobacco—	
system—		black—	
farm, recommendations.....	259-264	root rot, control by rotations.....	416
faults and remedies.....	16	shank, control by rotations.....	416
faults in, cause of land misuse.....	9	byproducts, preparation and fertilizer value.....	518
Tenant—		crop, fertilizer grades used and application.....	539
contracts, recommendations.....	259-264	deficiencies, grown in cultures, key.....	800
farm—		fertilizer application, recommendations.....	560-561
financial interests, protection.....	262-264	harvested, nitrogen content.....	371
need for security.....	259-261	potash content.....	399
Tennessee Valley, farm mapping.....	1010-1011	soil requirements.....	772-773
Tennessee Valley Authority—		utilization of phosphorus.....	393
cooperation with—		Toledo soil area, description.....	1117-1118
farmer on soil-conservation plans.....	283, 284-285	Tomato bacterial canker, control by rotations.....	415
farmers.....	17	Tomatoes, soil requirements.....	776
work with phosphatic fertilizers.....	202-203	Top-soils, average chemical composition.....	802
Tenure. <i>See</i> Land tenure.		Topography—	
Terminal soil area, description.....	1119-1120	of land areas, effect of soil erosion.....	583-590
Terra Rossa—		relief as factor in soil formation.....	966-968
soils, classification.....	994	Traditions, attitudes and institutions, causes	
use of term.....	991	of soil misuse. L. C. Gray, John B. Bennett,	
Terrace—		Erich Kraemer, and W. N. Sparhawk.....	111-136
absorption-type, construction and use.....	649-650	Transpiration, process, description.....	906
drainage-type, construction and use.....	650	Trenary soil area, description.....	1026-1027
types and construction.....	649-652	TRUOG, EMIL: Soil Acidity and Liming.....	563-580
Terraces—		Tucumcari soil area, description.....	1089-1090
division by strip-cropping system.....	644	Tumacacori soil area, description.....	1094-1095
use in erosion control.....	31-32, 625	Tundra soils—	
value in erosion control work.....	600-601, 604-606	characteristics, environment, and use.....	996
Terracing—		classification.....	993
cooperative work in Tallapoosa County,		formation.....	975
Ala.....	203	Tupelo gum (tree), indicator of soil series.....	842
practices.....	649-652, 653-655, 657, 668-669		



Page	Page
TURNER, H. A.: The Causes: Defects in Farming Systems and Farm Tenancy. With M. R. Cooper, W. J. Roth, J. G. Maddox, and R. Schickel.....	137-157
Turnips, potash content.....	399
Underwood soil area, description.....	1126-1127
United States—	
irrigation practices. Wells A. Hutchins, M. R. Lewis, and P. A. Ewing.....	693-703
soil-erosion problem.....	590-593
soils. Soil Survey Division, Bureau of Chemistry and Soils.....	1019-1161
v. Butler, Supreme Court decision.....	306, 308-317
Upshur soil area, description.....	1123-1124
Urea—	
classification as fertilizer.....	495
description, production, and value as fertilizer material.....	511
Utz, E. J.: The Coordinated Approach to Soil-Erosion Control.....	666-678
The Problem: The Nation As a Whole. With Charles E. Kellogg, E. H. Reed, J. H. Stallings, and E. N. Munns.....	84-110
Uvalde soil area, description.....	1093-1094
Vaiden soil area, description.....	1108-1109
Valentine sand areas, description.....	1136-1137
Valera soil area, description.....	1127
Vanadium, effects on animal and plant development.....	827
Vegetable crops—	
fertilizer application, recommendations.....	562
soil requirements.....	773-776
Vegetables, root, soil requirements.....	775-776
Vegetal cover—	
management for erosion control.....	623-624
See also Vegetation.	
Vegetation—	
dense, effect on soil and water losses.....	594
effects on soil and water conservation.....	619-620
national forests, management technique.....	226-230
physiological and ecological balance with soils.....	835-840
restoration by acquisition of areas for watershed protection.....	614
retardation of surface run-off.....	622-623
role in developing soil.....	963-964
thick-growing, value in erosion control.....	615-633
C. R. Enlow and G. W. Musgrave.....	615-633
types—	
found on western raw lands.....	856-857
indicators of soil series.....	840-854
relation to humus under.....	934-937
use in erosion control on farms.....	624-626
value—	
in erosion control work.....	602-606
in intercepting rainfall for soil surface protection.....	620-621
of mechanical devices.....	626-628
See also Vegetal cover.	
Vergennes—	
clay—	
loam, potash content.....	398
potash content.....	398
soil area, description.....	1117-1118
Vermont Agricultural Experiment Station, experiments with manure.....	458
Vernon—	
fine sandy loam, water and soil losses under strip cropping of cotton.....	639
soil area, description.....	1086-1087
Vetch, hairy, value as cover crop.....	440, 441
Victoria soil area, description.....	1109-1110
Vigo soil area, description.....	1104
Virgin Islands—	
Aquilita soil area, description.....	1144-1145
Descalabrado soil area, description.....	1145-1146
Guayama soil area, description.....	1145-1146
soils of, description.....	1137-1147
Soller soil area, description.....	1144-1145
Vista soil area, description.....	1097-1098
Volusia soil area, description.....	1038-1040
Walla Walla soil area, description.....	1083
WARBURTON, C. W.: The Remedies: Education and Research. With C. B. Manifold, Charles E. Kellogg, and C. P. Barnes.....	198-222
Water—	
absorption, in soil, increase by mechanical methods.....	653-654
agent in soil erosion.....	583-589
available supply, relation to plant growth.....	700-702
capacity, root zone, factors affecting.....	707-708
conservation—	
effect of soil cover.....	610-620
effect of soil erosion on.....	103-110
project in Texas, land treatment.....	603-606
control in national forests.....	228, 230
diversion measures.....	647-662
duty, definition and calculation.....	699-700
erosion. See Erosion, water.	
grass, indicator of soil series.....	844
hyacinth, composition, range, and value for soil improvement.....	518
in soil. See Soil water.	
irrigation. See Irrigation water.	
losses—	
from areas of clean tillage and dense vegetation, comparison.....	594
from grass and row crops on various soil types and land slopes.....	620
strip cropping of cotton.....	638-639
passage through soil, effect of root structures.....	964
power development, effect of soil erosion on.....	103-110
relations of soils. L. B. Olmstead and W. O. Smith.....	897-910
rights, laws and customs relating to.....	698
supply—	
and conservation in dry farming.....	684-688
effect on chemical composition of crops.....	792-794
relation to soil and soil solution in irrigation agriculture. C. S. Scofield.....	704-717
utilization program, Federal projects.....	256-259
Waterfowl population, decreases and present restoration measures.....	79-83
Watershed—	
area in Texas, soil-erosion survey.....	603-606
protection, acquisition of areas for restoration of cover.....	614
Waterways, vegetated, use in erosion control on farms.....	624
Webb soil area, description.....	1085-1086
Webster soil area, description.....	1054-1055
Weed control, effect of rotations.....	417-419
WEHRWEIN, GEORGE S.—	
The Remedies: Policies for Private Lands. With Clarence I. Hendrickson, M. H. Saunderson, Philip M. Glick, Carl C. Taylor, Francis R. Kenney, and Marshall Harris.....	241-264
The Remedies: Policies for Public Lands. With Earle H. Clapp, E. N. Munns, I. H. Sims, and C. F. Clayton.....	223-240
Weld soil area, description.....	1092
WELLS, O. V.—	
The Remedies: Direct Aids to Farmers. With J. P. Cavin and D. S. Myer.....	279-288
The Remedies: Economic Stabilization. With Bushrod W. Allin.....	289-295
Wells, drainage, uses.....	720-721
Wellston soil area, description.....	1043-1044
West Virginia Agricultural Experiment Station, work with fertilizers.....	520
Western States, land-use adjustment projects.....	237
Westmoreland soil area, description.....	1052
Wethersfield soil area, description.....	1032-1033
Whale tankage, fertilizer value.....	518
Wheat—	
chemical composition—	
changes, relation to water supply.....	793
effect of nitrogen.....	794
crop—	
effect on nitrate content of soil.....	350-351
fertilizer grades used and application.....	539
flag smut, control by rotations.....	415
harvested, nitrogen content.....	371
potash content.....	399

	Page		Page
Wheat—Continued.		Wisconsin—	
prices, effects of easy credit.....	273	rural land zoning ordinances.....	242-245
purchasing power and prices, fluctuations.....	182	tax-reverted land policy.....	233-234
regions, rotation practices.....	425-427	Wisconsin Agricultural Experiment Station,	
rotation—		experiments with manure.....	455
plan.....	413	Wood ashes, composition and fertilizer value.....	518-519
practices.....	425-427	Wooster soil area, description.....	1051
scab, control, effect of tillage.....	325-326	Works Progress Administration, grants for re-	
soil requirements.....	760-761	lief.....	127
Turkey, growing on different soils, chemical		World War—	
composition.....	789	economic consequences.....	185
Wheatgrass—		effect upon land values.....	121
bunch, indicator of soil series.....	849	influence on fertilizer materials.....	488-492
slender, indicator of soil series.....	844	influence on potash supply in United States.....	491
sod, indicator of soil series.....	849	Worms, aid to soil development.....	946, 965
White House soil area, description.....	1094-1095	Worthington soil area, description.....	1021-1022
White Store soil area, description.....	1074		
WHITNEY, MILTON, work in soil science.....	883	Yearbook, 1928—	
WICKENS, DAVID L.—		brief summary.....	2-44
The Causes: Imperfections in Agricultural		objectives, outline.....	[46a]
Finance. With R. Clifford Hall and		Yellow poplar. See Poplar, yellow.	
Donald Jackson.....	158-170	Yellow soils—	
The Remedies: Changes in Agricultural		formation and characteristics.....	973, 974
Finance. With Donald Jackson, R. Clif-		nitrogen content.....	366
ford Hall, and Roy M. Green.....	265-278	phosphorus content.....	381
Wiesenboden soils—		Yellow Podzolic soils—	
description.....	1110-1118	characteristics, environment, and use.....	998
See also Meadow soils.		classification.....	994
Wildlife—		description.....	1058-1075
habitats and drained areas, problem. F. R.		formation and characteristics.....	974
Kenney and W. L. McAtee.....	77-83	formation, effect of humidity.....	962
restoration measures.....	80-83	Yellow Podzolic Lateritic soils, in Puerto Rico,	
Willamette soil area, description.....	1050-1051	description.....	1138-1140
WILLIAMS, K. T.: Selenium in Soils.....	830-834	Yellowish-Brown Lateritic soils—	
Williams soil area, description.....	1083-1084	characteristics, environment, and use.....	998
Wilson soil area, description.....	1105-1106	classification.....	994
Wilt—		in Puerto Rico, description.....	1140-1142
control by rotations.....	415	of Hawaiian Islands, description.....	1154-1155
Granville, of tobacco, control by rotations.....	416	Yields, instability, factors.....	172-173
Wind—		Youth, farm, migration to cities.....	119
agent in soil erosion.....	583, 589-590	Zaneis soil area, description.....	1057
effect on soil formation.....	963	Zanesville soil area, description.....	1043-1044
erosion. See Erosion, wind.		Zinc, effects on animal and plant develop-	
strips, value in erosion control.....	664	ment.....	827-829
velocity, combating in erosion control.....	662-665	Zita soil area, description.....	1058
Windthorst soil area, description.....	1074-1075	Zoning—	
Winner, S. Dak., farm plan for cooperative		ordinances for control of land use, benefits.....	266
erosion control.....	676-678	rural lands, policies.....	241-245
Wire grass, indicator of soil series.....	846		